Nursing In An Austere Environment

READ THIS FIRST!

Disclaimer: The editors and author accept no responsibility for the use or misuse of this information. The practice of medicine is something that should only be undertaken by trained professionals. If you start administering medical or surgical treatments without the appropriate skills you will kill someone. Even in emergency situations often no action is better than uninformed and untrained action. Any practice of austere medicine should be backed up with appropriate training.

Much of this information is offered to give you perspective of what may be possible in a long term catastrophic disaster or when working in an austere or remote environment without access to organized or trained medical care – in no way do we endorse practicing these techniques except possibly in such a situation.

This information is taken from two main website's; California Public Health Disaster Nursing Handbook and should not be taken to represent professional opinion or to reflect any views widely held within the medical community. Appropriate additional references should be consulted to confirm and validate the information contained in this book.

- Shawn

Contents

		Page
Chapter 1	**A Medical Professional Role in a Disaster**	**4**
	General Information	4
	Defining Austere Nursing Practice	5
	Developing the Proper Mindset	5
Chapter 2	**Basic Austere Care**	**7**
	Water	7
	Food	7
	Warmth	7
	Linen	7
Chapter 3	**General Patient Care Considerations**	**8**
	Holding/Observation/Recovery Care	8
	Care Planning	8
	Basic Nursing/Patient Care Tools	9
Chapter 4	**Providing On-Going Care**	**12**
	Patient Data	12
	Patient Positioning	14
	Personal Hygiene	14
	Chronic Care	17
	Emotional Care	17
Chapter 5	**Childbirth in an Austere Care Environment**	**21**
Chapter 6	**Improvised Medical Supplies/Instruments in a Mass Causality or Disaster Situation**	**25**
Chapter 7	**Responder Lifestyle in an Austere Environment**	**29**
	Lifestyle	29
	Pacing Yourself	29
Chapter 8	**Public Health in an Austere Environment**	**31**
	Infectious Disease in an Austere Environment	31

Preventive Medicine 31
Hand Washing 32
Water Purification 34
Solid Waste Disposal 36
Liquid Waste / Sewage Disposal 37
Sharps and Medical Waste Storage and Disposal 41
Hazardous Materials Management 43
Chemical Terrorism Agents and Syndromes 49
Potential Bioterrorism Agents 52
Quarantine and Isolation for Potential 52
Causative Agent/Disease Entity 57
Isolation Guidelines 57
Nuclear and Radiation Exposure 63
Explosions and Blast Injuries 70
Donning Procedure of PPE 76
Procedures for Removing PPE 77
Personal Precautions 78

Appendix A: NIMS (National Incident Management System) 82

Appendix B: Mass Fatality Management 85

Appendix C: The Basic Laboratory 87

Appendix D: Radio Overview 97

Appendix E: MFMT Nursing Guidelines For Patient Care 99

Chapter 1 A Medical Professionals Role in a Disaster

General Information

A medical professional will be expected to provide any and all of the following:

1. Provide for personal and family safety, and report for duty as soon as possible.
2. Assure access to accurate and current information and provide rumor control.
3. Exercise leadership and judgment in assessing patients for priority care.
4. Function at alternative sites for operations to treat the sick and injured, utilizing nursing personnel and available supplies and equipment.
5. Assist the community in both aggregate and individual living situations.
6. Prevent, monitor and control the spread of communicable disease in the community.
7. Staff mass vaccination/prophylaxis clinics as indicated.

Proper nursing care can be as much a lifesaver as it is a source of comfort. Whether professionally trained or home-grown the person charged by circumstance or design with providing for the day-to-day care of others needs to be ready to address the ever-changing and continuing needs of their patients. There will also need to be an acceptance from family, a more collective responsibility for caring for the sick and injured, and that delegating all of the care which a sick patient currently receives from trained nursing staff in modern hospital to one person isn't practical or desirable.

Patient Care Technicians during a disaster will need to take a much more active role in helping the "nurse" look after their patient - assisting with companionship, monitoring, and feeding the patient.

For purposes of this course "nursing" refers to a type of care, i.e. ongoing day-to-day care as opposed to an occupational calling. The person(s) providing this care may have formal training of Licensed Practical Nurse, Certified Nurses Assistants, and EMT's at all levels. The goal is to provide for the entire range of physical and emotional demands caused by the disaster and the patient(s) illness or injury.

Nursing care begins in triage and leaves off once the patient is stabilized, discharged or evacuated. Not everyone will survive despite your best efforts. Often whether or not someone recovers from a traumatic event or a significant illness depends on the care they receive beyond the emergent or acute phases. Without excellent nursing care a person may survive and also recover nearly fully intact from a fractured femur, for instance, only to succumb weeks later to the effects of being kept bedfast. Blood clots in the lower legs caused by inactivity, infected bedsores that result from laying on their back for too long, or even pneumonia resulting from the use of a simple anesthetic other types agent such as ether, may claim them long after the fracture has been set and the road to recovery is being well traveled. Simple nursing measures even in an austere or limited resource environment can go a long ways towards preventing problems from occurring, or addressing them if they should.

On a more everyday basis there are also simple considerations to make austere nursing practical: how to properly assess a temperature using a basic digital thermometer, how to administer a proper injection, reducing fever with simple measures that do not include medications, and ensuring proper nutritional support.

Defining Austere Nursing Practice

Austere nursing care is "the provision of ongoing treatment over a period of days, weeks or longer, using limited resources, little or no outside support and in the absence of a working modern medical care system". The role of the medical professional in providing austere care differs greatly from that of the "traditional" medical care. They must be adept at improvisation. Even if educated in the traditional model of nursing by way of a college, university or hospital-based program one may find themselves thrust by circumstance or design into a role for which all your education and experience have failed to prepare you.

You may have to be your own lab technician, physical therapist, nutritionist and beyond. You may have the luxury of working with others or find yourself practicing completely independent of all outside assistance. Protocols and treatment regimens may have to be formulated on the fly depending on available resources and working conditions. Whatever your background you may be expected to provide continuous, ongoing care lasting anywhere from days to weeks, or even in some rare circumstances months. In that respect the care provided is no different from the traditionally accepted nursing model of the day-to-day caregiver.

Successful practice of austere nursing may require you to assess, diagnose and treat based upon your own assessments absent the assistance of others educated beyond a basic nursing level. You may find yourself making decisions about what antibiotics to use or recommend, whether to close a wound or leave it open to heal by granulation, how to best address the nutritional requirements of your patient(s) and how to best ration scarce resources. In the end the ultimate responsibility may be yours alone to bear. The line between nursing care and medical care is a thin one and frequently crossed. Much of what is discussed in is relevant to every day nursing care and vice versa. Remember this: by virtue of the circumstances under which you will be providing austere nursing care your decisions must be based upon what is in your patient's best interests and not necessarily always governed by medical-legal considerations. If our world were in proper working order there would be little call for austere practices to begin with.

There may be no such thing as normal scheduled shifts, internet or email for reference or resupply a phone call or fax message away, and possibly no physician or other higher medical authority within in communication. Where regulation leaves off common sense and ethical considerations have to take over.

Developing the Proper Mindset

The first step in the process of adapting to the austere environment is developing the proper mindset. As stated above the rules by which modern medical care is provided have may have limited application here. In an austere environment you may find that:

The system has broken down entirely either on a local scale or across the board.

The system doesn't apply, such as in backcountry areas of third world, and even some first world nations (examples of the latter: the Alaskan bush country, the Hudson Bay region of Canada, or the Australian Outback).

Occasionally circumstance prevents communication with the proper authority either due to the disaster itself, physical difficulty or because of severe time constraints. Examples would include:

Lack of phone lines, radio-signal dead areas due to terrain or distance, or roadways blocked by physical obstacles (flooded rivers, mudslides, avalanche, and deep snow).The time spent attempting to communicate with the proper authorities would endanger your patient.

Assuming one is trained, licensed, and authorized to practice as an appropriate health care provider you will have to fall back upon the premise of what any reasonably competent person with equivalent skills and training would do given the same set of circumstances. A modern example would be nurses and other caregivers responding to the World Trade Center crashes or the Japanese earthquake and tsunami. Emergent and on-going care was provided in both situations without benefit of prior authorization or proper tools, making do with what was available based upon the assessed needs of those requiring care and the given environments.

In the absence of formal training a prudent person will identify their skills and the resources available and act within those boundaries. There is a wealth of information contained within the pages of this manual that will set you well on your way to providing quality care under difficult circumstances. The overriding premise here is first to do no harm. Tightly linked with that premise is actually knowing what may legitimately constitute harm to begin with. The perceived benefits must outweigh the likely risks.

Use of this document does not constitute a license to practice medicine. **Whatever the situation may be, you are morally if not legally bound to operate within the generally accepted standards of the ethical provision of care that aids in the recovery or comfort of your patient(s) without causing detriment by way of deliberate omission or a willful act of harm.**

Chapter 2 Basic Austere Care

This is an odd section title but it accurately describes an extremely important basic nursing function. It mirrors the fundamentals of what is required for survival food, warmth, shelter, water, clothing except when you are looking after patients you must provide these essentials for them. Absent imminent threat these are the most basic of all nursing care functions.

Water
Water is second only to air as being important to life. A person may survive weeks with no food but as little as 72 hours with no water. Ensuring adequate hydration is a significant part of basic nursing care.

Lack of proper hydration may lead to prolonged healing, decreased ability to fight infection, altered levels of awareness, improper waste elimination, and in severe cases organ failure and eventual death.

Food
Patients may require varying diets that may differ significantly from what they are used to. For something as simple as a tooth extraction a diet of soft breads, ground meats and mashed vegetables may be all they can tolerate due to difficulties chewing. Two recommended books that include dietary information are War Surgery Field Manual and Where There Is No Doctor.

Warmth
The old adage about treating for shock by keeping a person warm has more than a ring of truth. Not only shock but also any number of ailments as well as injuries may cause a person to lose body heat. This is in addition to the issue of comfort. Besides covering them with warm blankets think in terms of warming the bed itself. Try a hot water bottle, or “hot pack”, or an old fashioned bed warmer.

All have been used for hundreds of years with good results. In the austere environment looking to the past for answers may provide answers to issues that otherwise seem insurmountable.

Linen
Clean linen is one of the keys to providing good nursing care – sheets, blankets, wash cloths and towels. Until you have actually provided nursing care to a person it is hard to believe how much linen you can go through in a day.

Chapter 3 General Patient Care Considerations

The trick to learn for patient care in an austere situation is to do what you can do extremely well. You may not have access to medications or much equipment but do what you are able to do well and you will save lives. Basic hygiene and basic nursing care don't require much to be done well. The classic survival cliché is a simple scratch could result in you dying from gangrene infection of the leg. While at the extreme end of the spectrum this may be true cleaning the wound with copious amounts of water and keeping it covered will prevent most infections; if there are signs of infection further good basic wound care, resting the limb, and keeping it elevated for 48-72 hours will further the chances of serious infection all without antibiotics.

Now obviously sometimes antibiotics will be lifesaving but you can reduce the reliance on high tech treatment by doing low tech treatments well.

Holding/Observation/Recovery Care
Once a patient's traumatic or medical situation is addressed in the emergent phase we move into the non-emergent, or the holding/observation phase. During this period we will be concerned with addressing the continuing problems created by the illness or injury. Assuming that the patient will be discharged or evacuated within a few hours our job of providing for such cases is simply a matter of ensuring that observation continues or that the patient's condition at least remains stable. If there is no outside assistance likely in the foreseeable future our task is then to ensure the patient's eventual recovery to their former state of health.

For most people this phase will be the most-time consuming. The patient may be suffering the after-effects of an acute illness, or require regular care for healing wounds and/or acute injury. In either situation their care is likely to require regular assessment of vital signs, elimination, pain, and overall function.

Depending on the situation during this phase of care you may be expected to administer medications on an ongoing basis, perhaps change dressings and apply various treatments intended to promote healing of wounds and/or injuries, provide some or all of your patient's basic needs. You will need the use of various tools that make this phase of care practical, and to know the tricks that make such care practical as far as time and effort.

Care Planning
Just as important is taking time to step back and assess the overall situation and devise a plan of care to guide your efforts. This is not as complicated as it sounds. In the hospital and long-term care environments nurses develop what are routinely called "care plans." These are detailed plans of care that are intended to be unique to each patient's needs, and tend to be as much centered on medical-legal considerations as actual necessary care issues. For our purposes we need only to have a basic patient care plan in place that is intended to ensure that the major aspects of required care are not overlooked.

An ***example*** of a simplified care plan might take the following form if written out:

- Vital Signs: Check every 10 minutes if patient is unstable, every 1 hour if stable and record.

- Nutrition: Soft foods high in protein, 5 small meals per day totaling approximately 1,800 calories, snacks in evening as appropriate.

- Positioning: Elevate broken extremities on pillows to keep above heart level. Use propping pillows to position from side to side at regular interval.

- Elimination: Check every 2 hours to see if they need the bedpan or urinal.

- Pain: Assess pain level every 3-4 hours and give medication as needed.

- Medication: administer scheduled medication at 8:00 AM, 4:00 PM and Midnight.

For an uncomplicated case of flu with only one caregiver care a written plan, as simple as it is, may not be needed. Simply establish a routine and follow it. If more than one patient is involved or there is more than one nursing care provider having a simple written plan of action can eliminate potential mistakes and miscommunication such as administering medication twice or overlooking a significant change in the vital signs.

Basic Nursing/Patient Care Tools in an Austere Environment
As with any other endeavor you will require certain tools of the trade. Tools to assess vital signs, to address bodily functions, to make administration of medications possible, and to make ongoing care practical. Aside from obviously disposable items such as bandages and dressing's durable goods are the most practical for situations where resupply intervals may be few and far between, or even non-existent. Glass and stainless steel are two of your best friends in such situations.

You will need tools that measure blood pressure, pulse rate, weight, fluid volume, and size (length, circumference, and diameter), and temperature. Examples of such tools would be:

Blood pressure cuff: Mercury column, aneroid (dial-type) gauge, or an electronic device such as a wrist or self-inflating arm cuff. Mercury column devices maintain calibration longer than other types and can be used to calibrate aneroid gauges, which are more portable. Electronic devices are great timesavers but are more prone to loss of calibration and inaccuracy as batteries are depleted.

Watch or clock: In order to obtain accurate pulse and breathing rates you need a digital display with a seconds' count, or a sweep-hand that is marked in seconds as well as minutes.

Graduates and other fluid measuring devices: Used to accurately measure urine output and also fluid intake. Common kitchen measuring devices with a capacity of 32 oz (1 liter) or greater will work well. A see-through container with measurement markings will make the task much easier. This may see a lot of use so durability is preferred.

Stethoscope: Assessing lung and bowel sounds is a basic part of nursing care. You are checking for abnormal sounds in the lungs, and the presence or absence of sounds in the abdominal area. A good quality single-head stethoscope with spare diaphragms is a must-have piece of equipment.

Fabric Tape Measure: Wounds may need to be measured to gauge healing progress. Edema (swelling) needs to be measured to determine if treatments are effective. Bandages may need to be measured for fit. A measuring device that will wrap around an extremity is more practical than a rigid ruler.

Thermometers: Thermometers have a variety of uses in the austere environment. Fever charting can confirm a diagnosis or help you differentiate between diseases. Knowing core temperatures is important in managing environmental emergencies. Body temperature monitoring also has other applications.

Determining morning basal temperatures (by taking the temperature first thing in the morning before getting out of bed or moving around much) is important in identifying and managing certain chronic conditions.

Clinical thermometers used to be all one of one basic kind - the mercury thermometer - but today you have a variety of options, including electronic thermometers, electronic tympanic membrane thermometers, and single use (disposable) thermometers. All have advantages and disadvantages.

If you expect to be in the austere environment for an extended period without resupply you should choose the old-fashioned digital thermometer, since they will keep working forever if you don't break them. Electronic thermometers have the advantages of speed and accuracy (digital basal thermometers are available with readouts to 1/100th of a degree, for instance), but you will need batteries or some other means of powering them (use at least a rinse followed by a dry wipe followed by an alcohol pad wipe to clean them between uses if you don't have the sheaths). Electronic thermometers may also be usable over wider ranges than conventional thermometers. Electronic tympanic membrane thermometers (which let you read temperature from the ear) make it easy to avoid cross-infection, but again, they need a power supply. Disposables are great for preventing cross-infection, but when they're gone, they're gone.

Avoid taking the temp immediately after activity, a bowel movement or a bath or shower.

To use a thermometer in the armpit; place thermometer in the pocket of the armpit with the arm held down to the side. Obtaining an accurate axillary temp takes 11 minutes. Axillary temps are considered to be 1 degree Ferinheight cooler than a true core temp so add 1 degree.

Normal Healthy Body Temperature
A normal healthy body temperature is 98.6 F (37 C) is generally considered to be ideal, with 98.0 to 99.0 the generally accepted “normal” ranges for healthy persons. In the elderly 2 degrees below “normal” may be their actual normal body temperature. Thus 98.6 may actually represent a fever in some people in these individuals.

The key is in knowing what is normal for that person.

Abnormal Temperatures
105 F is very high in an adult, potentially life-threatening. In that range damage to the brain, blood, muscles, and kidneys is increasingly likely. Anything over 100 degrees should be addressed. Small children may spike temps of 105 and even 106 for short periods and not suffer ill effects, but as we age our tolerance for fever decreases. 103 is very high in the elderly and cause for serious concern whereas for most adults and even children 104 (40 C) is still relatively safe but bears close watching. In any event active cooling measures should be undertaken before it reaches that level if possible.

Bandage Scissors: Designed to cut away bandages next to the body without poking holes in your patient. They combine safety with practicality.

Permanent Marker: To write on dates or times on dressings to know when they were last changed if there is more than one caregiver. Also used to mark disposable items that should not be shared between patients. Also used to mark skin (it wears off with repeated washing and normal skin replacement).

Transfer Belt: Known by various names such as walking belt, safety belt, gait belt, etc. The commercial version is a 3" wide sturdy fabric strap that is easily buckled around the patient so the caregiver can assist them with standing up, transferring, or walking. It can also be fashioned from a pair of sturdy pants suspenders or an ordinary (wide) clothing belt. It provides a handle for the caregiver to grab on to by placing it around the middle (lower stomach area) of the patient and holding onto the rear of the belt.

Clothing Protectors: Another simple yet important item that can be fashioned readily from any soft or fluid resistant material. Intended to catch spills while eating/feeding and protect the patient while washing hair or performing treatments.

They may tie behind the neck or have a wrap-around collar that fastens with Velcro. By protecting from spills they also save a lot of time by guarding against the necessity of clothing and bed linen changes.

Flashlight: This serves a dual role as both as assessment tool for the eyes, ears, nose and mouth, and the means to check a patient at night without awakening them with overhead lighting. Room lighting is not always adequate to view whatever may need to be seen.

Gowns: Caring for people may routinely require exposing differing areas of their body for washing, administering medications, changing dressings and bandages or measuring vital signs.

Having to undress a person each time is time-consuming and impractical as well as potentially painful. Modesty dictates that we be able to cover the patient when exposure is not otherwise needed. Open back gowns while the bane of hospitalized patients world-wide represent the most practical means of combining protection with accessibility when shirt and pant style clothing is not practical or possible, as when casts or external appliances interfere.

Something as simple as a sheet cut poncho-style will work nicely as well.

Chapter 4 Providing On-Going Care

Having identified our goals we can move on the issue of how we are to address them. There are several areas that need to be addressed as part of the entire care "package" or plan.

Patient Data

Vital Signs
Having a database of vital signs is the key to recognizing abnormal vital signs later on. In an ideal situation you would have a record that details normal laying, sitting and standing blood pressures for your patient, as well as a resting pulse, and respirations, along with a temperature. Make sure to note whether the normal pulse is regular and strong in quality and rhythm, or irregular, weak, or bounding (very strong). Illness and/or injury may cause these measurements to change drastically. For the moment we will concentrate on a few of the "whys."

Temperature
Temperatures can be used to monitor for the presence and progression of infections, adverse reactions to medications, and dehydration. Having a database of temperatures over time will allow you to gauge the effectiveness of antibiotics, for instance, or the onset of an infection. Similarly a person who is acutely dehydrated will see an increase in their temperature.

Pulse
Pulses may indicate a general state of health in the absence of illness or injury. A very rapid, thin pulse may indicate the presence of shock, whereas a slow pulse might signal that the patient is relaxed and relatively pain free. Since pulse rates vary widely among people the change in pulse rate and quality is more important than the rate itself. For example, for a person whose normal pulse rate at rest is 68 an increase of 20 per minute may indicate the presence of unaddressed pain.

Where to Obtain a Pulse
The pulse can be checked at the vertical notch of the neck next to the throat (carotid artery), the inside wrist (radial artery), in the groin, behind the knee, and on the top of the foot. As a general rule of thumb the weaker the blood pressure the higher you'll have to check for a pulse, though there is no concrete rule indicating what level of blood pressure will result in a pulse at what site. A pulse can also be heard using a stethoscope placed over the left chest above the heart (called an apical pulse). Either count for a full minute or for 30 seconds and multiply x2 to determine the pulse rate.

Blood Pressure
Blood pressures are always obtained using a blood pressure cuff, either manually operated or electronic. Cuffs come in different sizes with a standard blood pressure cuff suitable for adolescents and adults. An upper arm larger than approximately 15 cm will require a larger cuff for an accurate reading or a false high will result. Conversely an arm smaller than approximately 8 cm will require a smaller diameter cuff or a false low reading will result.

Breathing
Normal breathing rates for an adult range between 14 and 20 per minute, or one breathe every 3 – 4 seconds. During times of illness this may increase, with more than 30 breaths a minute considered very significant.

In addition to rate the apparent effort used to breathe can also be indicative of distress or absence of same. In a healthy person breathing should come easily and gently. Respiratory infections can cause labored breathing, evidenced by increased effort and rate. By tracking breathing rates and quality along with other vital signs it is possible to determine whether treatments are having a positive effect.

Other Data to Collect and Record

Bowel Movements
As we age our bowel movements tend to become less frequent. Normal for an infant is several loose stools each day. Adolescents and adults may have one per day. Older adults may not have a proper bowel movement for several days without regular use of fiber in their diet and/or laxatives. As a rule a person should have one medium to large bowel movement at least every 3 days.

Urination
It is not necessary to record urine outputs for everyone but for some cases especially burns measuring output against fluids taken in (Intake and Output) is necessary to determine whether fluid balance is being maintained. A healthy adult can be expected to void (urinate) 1,500 ml or more per day. The effects of disease, loss of fluids through other sources such as perspiration, vomiting, bowel movements, etc may affect this somewhat but as a general rule plan on a measured output of one and a half liters. Anything less than half this amount may be indicative of kidney malfunction and is cause for serious concern.

For certain types of patients, such as burn cases or those with heart failure, matching Intake and Output (I & O) against daily weights can be critical to determine if an output deficit is the result of retained fluids.

Weight
Weight by itself may mean little other than as a general indication of nutritional status but changes in weight can be significant in terms of indicating changes in the patient's condition. For instance fluid retention or loss can vary a person's weight by several pounds (1–2lbs) per day.

Sudden fluid gain can precipitate heart failure, and also may indicate failing kidney function if present along with decreasing urine output. Sudden weight loss normally indicates a loss of fluids from the body, a very important consideration with large-scale burns where we want to achieve balance in the body's fluid load.

Bed Mobility
The ability to change positions in bed is often taken for granted by those not affected by illness or mobility problems. Pressure sores, which will be addressed later in this section, are one potential problem of immobility. Increased tendency towards pneumonia is another.

Positioning
Positioning can be defined as the art of arranging the patient properly to encourage maximum retention of function, comfort, and accessibility.

As simple as it seems improper positioning can and does lead to breakdowns in skin integrity, loss of function of limbs, and prolonged recovery times.

Elevation
Elevating the head of the bed aids in breathing for some people, especially in instances of pneumonia, asthma, and emphysema, and can assist with keeping the airway clear. It is also more conducive to eating and taking liquids. Simple techniques for achieving this in a bed not otherwise designed for the head to be elevated are to use blocks under the legs at the head end, or to place blocks, pillows or other items under the upper portion of the mattress.

Positioning Pillows
To reduce any tendency towards pressure sores and to increase patient comfort it is common practice to alternate the way patients lay by positioning them first on their left side, then their back, and finally on the right side before starting over, with changes every 2-3 hours.

Pillows are used to prop the person who is otherwise unable to lay on one side unassisted. They are also used to elevate limbs to reduce edema (swelling) and to provide comfort. Some people may also breathe better with two or even three pillows under their upper back and head.

Other Positioning Aids
Besides pillows, blanket rolls, and folded towels may be used. These can be used by placing them between the knees, for instance, of the person who finds having their legs in straight alignment with their body uncomfortable but as they lie on their side it’s a more comfortable pose.

Personal Hygiene
Personal hygiene is another significant area of concern. The patient may be unable to reach their back, for instance, due to arthritis or injury to the arms, back, or shoulders. They may be unable to bend at the waist and thus unable to cleanse themselves below that point.

Make arrangements to provide for regular bed baths, to trim fingernails, wash hair, and provide for basic oral hygiene by brushing teeth and rinsing the mouth.

Wiping the person daily with a damp cloth helps control the odor of perspiration with a complete bed bath every 3-4 days recommended for most people.

Bodily Functions
You will need to provide for your patient's elimination requirements: urine, feces, and perspiration (sweat). Don't forget also that since we may be dealing with illness emesis (vomiting) is also a potential problem that will need to be dealt with.

Pain Assessment
Pain is a particularly subjective experience with no two people experiencing it quite the same way. Identical injuries may elicit differing responses in different people. One person may find the same pain tolerable that another finds excruciating. There is no definitive measure of pain, but there are a couple of useful tools that offer clues as to how much pain the person is experiencing.

Pain is often measured using a 0 – 10 scale, with 0 (zero) being the complete absence of pain and 10 (ten) being considered to be the worst pain the person has ever experienced or the worst pain they can imagine, often referred to as excruciating pain.

Another scale often used is the 5-point scale which is graded as follows:

1 – No pain

2 – Mild pain

3 – Moderate pain

4 - Severe pain

5 – Overwhelming pain (the worst the patient can imagine)

In general any perceived pain that the patient describes as 2 (two) or above is worthy of being addressed, beginning with simple pain measures or remedies and progressing as needed. Ideally we would relieve the pain entirely but the very nature of austere medicine dictates that we may have to settle for reducing the pain to a level that is either tolerable for the patient or at least allows them to function.

Nutrition
As mentioned previously two books recommended in the previous section offer information about nutritional support in the austere setting. There is a wealth of information available both on-line and in print regarding nutrition but a few general suggestions are offered here:

Trauma victims in general and burn victims specifically, require significantly more protein on a daily basis than an otherwise healthy person. In the austere environment plant protein alone is likely to be insufficient to meet these needs. Animal protein (meat) will provide a better balance of the complex proteins needed to rebuild damaged muscle tissues.

Orthopedic patients may recover faster with the addition of calcium supplements to their diet.

In addition to milk and other dairy foods OTC supplements such as calcium-based antacid tablets may be of benefit to rebuilding damaged bones. Following invasive procedures that involve the abdomen in particular a clear liquid diet is preferred until the patient regains normal bowel function. Clear liquids consist of water, broth, gelatins (flavored or not), and tea (but not coffee). The general rule of thumb in determining what constitutes a clear liquid is the ability to see the bottom of the cup or glass through the contents.

Breathing Care

Patients with chest infections or chest injuries (who are prone to chest infections) may need some help with their breathing. The mainstay of treatment for difficulty with breathing is to treat the underlying problem and oxygen this is unlikely to be available to you, so you need to consider alternatives to assist with optimizing breathing.

Positioning is very important. Lying flat is not good for breathing. Semi-sitting or sitting upright is probably the best position for the patient with breathing difficulty.

Fully inflating the lungs with each breath also improves breathing, opening the smaller airways, and helping the body clear out mucus. This can be achieved by alternating asking the patient to try and blow up a balloon or a similar activity with sucking in through a straw for several minutes each 3-4 times a day.

Percussion and postural drainage has been used extensively to help drain respiratory secretions in chest infections. While traditionally done by a physical therapist or respiratory therapist, cystic fibrosis parents have been taught for years how to perform it on their children and it is very straightforward. It helps loosen mucus and purulent secretions, and helps them to be coughed up. The following is a simple overview of the process. It should be done with a cupped hand rather than a flat hand:

- Position the patient on his/her side on a pillow.
- Tilt the patient's head downward with his/her bottom above the level of his/her head. The position can be varied with the patient lying on their front or back the key point is the head down position.
- Gently tap your patient's side with a cupped hand just under the armpit and across back.
- Reverse sides and repeat until your patient is able to expel some mucus.

A more detailed description (especially of more accurate hand positions) can be found at: http://www.questdiagnostics.com/kbase/as/ug1720/how.htm

Simple devices that may assist with breathing care include steam and cool mist vaporizers.

Steam vaporizers are easy to improvise with something as simple as a pan of clean water set to heat near the patient and some sort of containment such as a plastic sheet, or even a cloth sheet if nothing else is available used to hold the mist in proximity to the patient.

Emotional Care
Emotional care is called for any time a person is ill or injured. It may be as simple as a mother's soothing words to a child with a stomach ache, or as involved as deliberate emotional support for the person who has suffered a significant injury and is experiencing a depression as a result of their misfortune.

Be aware that people experiencing ongoing pain and/or disability may become short tempered and irritable. This is usually an unconscious response on their part that improves with recovery or increased comfort. The caregiver needs to be understanding of this and separate a temporary condition from true personality traits.

Simple comfort measures, observance of modesty issues, and sometimes just providing an ear for the patient to express their concerns or frustrations to can go a long ways towards addressing these issues. The person who is the subject of your care is likely to feel vulnerable if not outright helpless. Anything that can be reasonably done to reduce these feelings will make the situation more tolerable for then Patient Care Technician and the patient alike.

Patient Physical Activity
Physical activity is a key issue for everyone. As noted previously immobile limbs tend to contract due to lack of muscle use. Simple range of motion exercises can aid greatly in preventing this as well as other complications. The key is gentle exercise. Limbs should be flexed and extended within the normal limits of the joints as practical. Fingers should be flexed as well as the wrists, elbows, and shoulders. For the lower extremities: The hips, knees, ankles, and the toes if practical.

The person whose care requires casting for a period of time will find that upon removal of the cast the immobilized limb will be very weak. Begin with simple stretching and bending several times a day as pain levels allow. Don't be discouraged when progress seems to be slow. Even a muscular individual will find full recovery easily could take weeks before they have their full strength and range of motion restored

Chronic Care
In a situation where eventual access to outside assistance is not foreseeable there may come a point where care converts from that aimed at recovery to simply providing ongoing care for a chronic condition. Whereas in cases of recovery, or subacute, care we center our care around rebuilding the patient's health here we are concerned with maintaining a level of health when further recovery is not likely. This does not automatically imply that the person is an invalid but rather than their condition has stabilized, and they have achieved as much healing as they are ever likely to absent a fully functional modern health care facility.

Some injuries or ailments simply cannot be fully recovered from under austere conditions, whereas others may require additional weeks or months of low-level care such as recovery from

a major long bone fracture or a spinal fracture that does not result in a functional deficit. The result may be the need for reduced but nevertheless continuing care requirements. The patient may be confined to the house due to impaired mobility for instance.

Even when able to move about with a wheelchair they still run the risk of future impairments due to their lack of full mobility.

For our purposes we are assuming that the condition is such that the person will eventually recover to the point that they are able to assume responsibility for most of their own care. They may still require assistance with such activities as preparing food, bathing, and getting into and out of bed, but are able to feed themselves, and move about with the aid of assistive appliances (wheelchair, crutches, cane, etc). A person who is truly bedfast and totally dependent upon others for all of their activities of daily living (bathing, eating, elimination, dressing, etc) will not likely survive long, succumbing eventually to infection or the effects of chronic immobility. While we intend to do what we can within the means available to us we must also face the possibility that some people will die no matter how attentive to their care we are. In this respect austere nursing care is no different from that of the present day.

Following are a list of potential conditions which the prevention of tops the list of concerns.

Bedsores
More properly termed pressure sores or decubitus ulcers. They result from the pressure caused by the body resting on the same point(s) without shifting the weight off of the point(s) of contact. They are common in people who use wheelchairs or who are bedridden even for relatively short periods of time such as following a surgery, or persons who are emaciated, paralyzed, or who suffer from decreased sensation. Key areas prone to development of pressure sores include the hips, the points of hip to the rear (the ischium), the sacrum (base of the spine), heels, and the shoulder blades.

General precursors to bedsores can be easily identified:

- Elderly
- Bedfast or wheelchair-bound
- Unable to move certain parts of the body without assistance due to injury, illness, or weakness
- Incontinence of bladder or bowels: moisture next to the skin can cause breakdown over time
- Fragile skin due to age, disease, or injury

Prevention is the key. Check daily for reddened areas that do not blanch (turn white when pressed), blisters, sores, or craters. Other useful measures include:

- Change position every two hours to relieve pressure.

- Use items that can help reduce pressure -- pillows, sheepskin, foam padding, or semi-firm air mattress (never allow the person's skin to lie directly on a vinyl mattress though. The sweat build-up will itself cause further problems).

- Eat healthy, well-balanced meals.

- Exercise daily including range-of-motion exercises for immobile patients.

- Keep skin clean and dry. Incontinent people need to take extra steps to limit moisture.

- Tincture of green soap is an older remedy used to toughen skin in order to make it less prone to breakdown. It is a combination of vegetable soap, lavender oil, glycerine, and ethyl alcohol that is biodegradable, mildly antiseptic, and good skin degreaser. It is used by applying it straight to the skin surface to be treated.

Bedsores are categorized by severity from Stage I (early indications) to Stage IV (worst):

Stage I: A reddened area on the skin that, when pressed, is "non-blanchable" (does not turn white). This indicates that a pressure ulcer is starting to develop.

Stage II: The skin blisters or forms an open sore. The area around the sore may be red and irritated.

Stage III: The skin breakdown now looks like a crater where there is damage to the tissue below the skin.

Stage IV: The pressure ulcer has become so deep that there is damage to the muscle and bone, and sometimes tendons and joints.

Once a bedsore has been identified continue with preventive measures described above and additional treatment should begin immediately to avoid further degradation of the tissue:

- Relieve pressure to the area using pillows, foam cushions, or sheepskin

- Moisture barrier ointments such as Calmoseptine will be of significant benefit for Stage I or II sores only.

- Coating the area with talcum powder or a similar product before applying the cream will allow it to be cleaned off easier and will also help dry the skin underneath of the barrier coating. Solid cooking shortening (Crisco) or even lard can be used in the absence of medical creams.

- Petroleum jelly, however, should NOT be used. The ointment or cream selected should be applied at least twice per day and perhaps as often as every 4-6 hours if the patient is frequently incontinent of urine.

- Improve nutrition. A good multi-vitamin at a minimum should be part of the care. Zinc supplements in particular are also very useful in preventing skin breakdowns.

- Keep the area clean and free of dead tissue. Use salt water to cleanse and gently remove dead tissue. Never massage the area though as it can damage the sensitive tissue underneath.

Deep Vein Thrombosis
More commonly associated in the lay press with "economy class syndrome" from air travel, deep vein thrombosis is a very common cause of death for bed bound patients. It occurs due primarily to prolonged immobility, and is worsened by conditions such as lower limb fractures, cancers, or a genetic predisposition to clotting.

The best treatment is prevention. Where possible even significantly unwell patients should be mobilized several times a day somehow – the benefits of bed rest need to be balanced against the risks of developing clots. Patients should not cross their legs in bed, and massage and stretching of the legs should be encouraged 3-4 times per day as a minimum. The best preventive treatment is daily injections of subcutaneous heparin but this won't be an option for most.

Contractures:
This refers to the tightening of the non-bony tissues of the muscles, skin, ligaments, or tendons. Unless promptly addressed the condition will become permanent. The primary symptom will be loss of motion in the affected joint(s), eventually followed by unrelenting contraction of the muscles. Depending on the affected extremity the arm may draw inwards, the leg will curl back into a fetal-like position, or the hand will develop a claw-like appearance. Once well-established the limb cannot be straightened even by the care provider.

Predisposing conditions include burns, trauma, immobility, and deformity. Age itself plays only a very small role. Anyone who is bedfast and who does not possess voluntary movement of their limbs can develop this condition if their muscles and joints are not exercised by stretching and bending.

Prevention is the key to avoiding this condition. You will need to implement a program of early movement and physical therapy in cases of acute or orthopedic injury. Each joint should be exercised separately. In the case of the leg, for instance, the toes, the ankle, the knee, and the hip should all be addressed individually.

Chapter 5 Childbirth in an Austere Environment

Childbirth

This is not the forum to discuss the mechanics of pregnancy, labor, or delivery. There are many excellent books (see references) on midwifery, which covers this in detail. The WDMRT MMCF has the basic components of an emergency delivery kit:

1. Your brain and your clean hands. These are the 2 most important things. You have to keep your wits about you and be ready to help if Mother Nature is having problems. The trick is in knowing just when to leave everything alone and when to help. Cleanliness is CRITICAL. Post delivery deaths from all causes dropped 95%+ when delivery attendants, midwives, and physicians started washing their hands with soap.

2. Something to suction the baby's nose and mouth out with. Like a bulb syringe, turkey baster, etc. You can also finger sweep the mouth or in a pinch put your mouth over the baby's mouth and nose and suck gently.

3. Clean cord, cloth strips, or cord clamps to tie off the cord, and a sterile (if possible – otherwise immaculately clean) instrument/blade/scissors to cut the cord. This is important. Neonatal tetanus from cord cutting with dirty instruments accounts for ¾ of all tetanus deaths worldwide. It's OK to leave the cord attached to and with placenta at an even level with the baby for a while until you can get a clean instrument if needed.

4. Gloves: Sterile are better but at least use clean unused exam gloves. If no gloves are available then ensure your hands are scrupulously clean.

5. Clean towels and pads, and blankets to wrap baby in, etc.

Hot moist packs can be placed against mom's perineum to help relax the muscles and tissue, and allow them to stretch easier with less chance of tearing. This is a technique which is completely lost in modern obstetrics that works well. Also ensure that you have a hand basin immediately available for frequent hand washing.

Most deliveries are very straightforward. This is why the human race has survived for so long. More than 90% of all healthy women will give birth with no problems at all. This still leaves a significant number of women who may run into trouble. Problems are more likely to arise with the first baby, with older mothers, mothers with previous delivery complications and/or multiple previous deliveries.

There are several areas where problems arise; the following is just an overview of the more common:

Obstructed labor/slow progress
Midwives are experts at encouraging slowly progressing labor without medical interventions. Currently if labor fails to progress it is augmented with oxytocin or a caesarean section.

When there is no prospect of vaginal delivery due to obstructed labor or malpresentation then there are two options for delivery: Forceps/suction delivery or caesarean section. Both require significant skill and equipment. The reality for most is that in a primitive situation this will be beyond the midwife; if the baby is unable to be delivered the mother will die.

Breech presentations
This is where the baby is coming bottom first rather than normal headfirst. The head is the biggest bit of a baby. During normal birth the head moulds itself and slowly stretches the birth canal to a size it can pass through. When the bottom comes first this slow stretching does not occur. As a consequence there is a risk of the head becoming stuck or the baby being asphyxiated before the head can be delivered. There are a number of measures, which are well described in the references aimed at delivering breech babies.

If the baby dies during the birth process they can usually still be delivered without endangering the mother's health.

Infection
One of the biggest killers relating to childbirth prior to the last century was infection. It is not uncommon today particularly with more complicated deliveries but fortunately it is very responsive to antibiotics. You need to pay very close attention to antisepsis, ensure that if possible sterile gloves are worn, sterile instruments are used, and if gloves are not available that you wash your hands very thoroughly with soap and water.

Post-Partum Hemorrhage
This can occur early (within 24 hours) or later. Late hemorrhage is almost always due to infection. Early bleeding is caused by failure of the uterine muscles to contract and close off the connection site of the placenta; lacerations of the cervix especially the anterior lip, vagina, vulva; retained fragments or pieces of placenta; abnormal location of the placenta during the pregnancy (like all the way into the uterine muscle); rupture of the uterus; inversion/prolapse of the uterus; bleeding disorders & coagulopathies (blood clotting problems) either as a result on inheritance or pre-eclampsia/eclampsia. The most common cause is failure of the uterine muscles to clamp down (atony), lacerations especially the cervix, and retained placental fragments.

The textbook definition of hemorrhage is more than 500 ml of blood loss although it has been shown that the average blood loss after an uncomplicated vaginal delivery is often in the 500-600ml range. Also note that vaginal blood loss is consistently UNDERESTIMATED by 50-100% so that if you think you lost 500 ml it's probably more. Blood loss after delivery is normal in this amount, and assuming that mom was healthy and not severely anaemic before delivery is not a problem. Also it is normal for bleeding to continue in small amounts after the delivery, and bloody mucus (lochia) can continue for some time. But continued bright red bleeding like a heavy period or greater amounts, increasing size of the uterus (womb), etc. is not normal. Post partum hemorrhage accounts for 5% of maternal deaths.

Treat for shock just as you would any hemorrhagic condition: Lay flat, keep warm, IV fluids if available, monitor vitals, etc.

Palpate the fundus (the top of the uterus); is the uterus firm and small (so well contracted and probably not the source of bleeding), soft and small (possibly not well contracted – maybe bleeding, or soft and big or getting bigger (not contacted and probably filled with blood)? Use gloves and examine outer vulva & rectum for tears, examine inside vagina for same, examine anterior cervical lip. Bleeding will either be coming from a visible source, or out of the cervix with no visible tears and, therefore, intrauterine – coming from within the uterus.

If the cause of bleeding is an obvious external or vaginal laceration manage appropriately with a repair.

Most heavy bleeding occurs simply because the uterus will not contract or a piece of placenta is left behind. Nipple stimulation either through breastfeeding or direct stimulation releases the hormone oxytocin which stimulates contractions and is the first treatment choice. Gentle rubbing of the fundus also stimulates contractions and should be tried. Large and soft, firm pressure on the fundus may expel accumulated blood clots and assist contraction. Also encourage or assist the mother to empty her bladder as this helps the lower part of the uterus to contract.

The second priority is to ensure the placenta is delivered if it hasn't been already and that it is complete. If the placenta is still inside or incomplete and bleeding continues to be heavy consider exploring inside uterus with a gloved hand for the retained placenta or pieces of placenta. You can also assess for inversion or uterine tear – this is very painful for mom if no anaesthesia is available, and there is a significant infection risk. Broad-spectrum antibiotics should be given if available.

If the uterus is empty and will not contract with nipple stimulation or rubbing of the fundus then bimanual compression should be considered. One hand is placed inside the vagina and the other hand is used to compress the uterus from the outside down onto the hand in the vagina. This is painful and also carries an infection risk but can be life saving. Ice water lavage may also help slow bleeding – do this just like an enema.

Anything other than a simple repair job should be covered with antibiotics due to high infection risk.

Most bleeding will be controlled with patience, avoiding panic, repair as indicated, ensuring no retained placenta fragments, thorough uterine massage, and breastfeeding. It is terrifying to watch a post-partum hemorrhage; often appearing like someone has turned on a tap – DON'T PAINIC.

What happens if the baby cannot be delivered?
If you have an obstructed labor or mal-positioned baby, and/or the baby is dead, and there are no facilities to perform a caesarean section then as unpalatable as it sounds, delivering the baby in pieces may be the only option to save the mother. If nothing is done the mother will die of sepsis.

If the labor is prolonged with the head deeply embedded in the pelvis, pressure injuries can occur in the mother's pelvic floor, causing a fistula between the vagina and the bladder or bowel to occur – these are very common in third world countries and very disabling.

This is extremely unpleasant but can be done with a sterile wire saw and scissors. The baby's head is decompressed and then it is removed in pieces. This is rarely required and is a last ditched solution to save the mother, as in a major disaster situation with no conceivable access to health care. If not done in a sterile manner infection will be introduced and will likely prove fatal to the mother.

Chapter 6 Improvised Medical Supplies/Instruments in a Mass Causality or Disaster Situation

Bandages and Dressings: Any absorbent material may be used as a dressing and any length of material for a bandage. It would be wise to identify what you plan to use in advance and ensure you store it. Wool when washed free of lanolin is very absorbent and is one possibility.

Table 1 contains an option for making and sterilizing your own bandages.

The primary problem with dressings will be with sterility. Provided the material used for dressings is clean, in most cases this will have very little impact on the incidence of infection. If you require a higher degree of sterility boiling your dressing material and then air-drying prior to use is an option – not perfect but this will give you a degree of sterility.

Hemostatic Dressings: It is worth noting that TraumaDex is nothing more than purified potato starch and HemCon purified shrimp shell derivative ground up and placed in a bandage matrix.

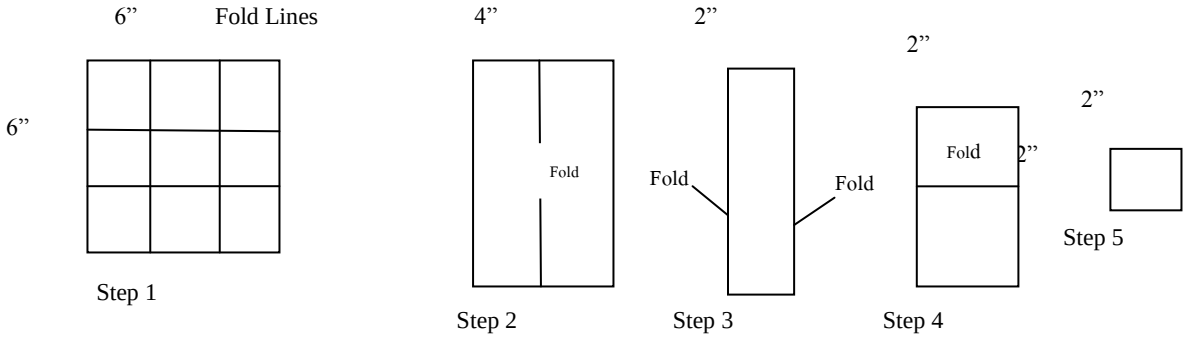
Table 1. Homemade Dressings

Here's what you will need:

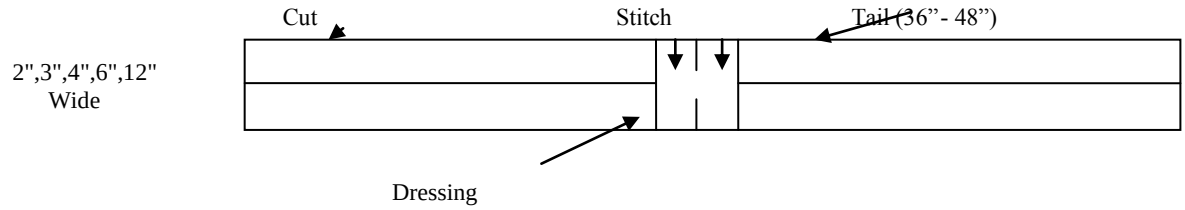
• White material for dressing (100% cotton is most absorbent)
• Colored material can be used for the bandage tails, if desired.
• Sewing machine
• Aluminium foil
• Oven

Cutting and Folding Dressings

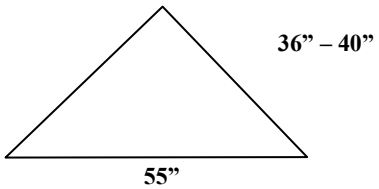
Wash and dry material.
For a 2"x 2" dressing, cut a square of white fabric 6"x 6" square.
For a 3"x 3" dressing, cut a square of white fabric 9"x 9" square.
For a 4"x 4" dressing, cut a square of white fabric 12"x 12" square.
For a 6"x 6" dressing, cut a square of white fabric 18"x 18" square.
For a 12"x 12" dressing, cut a square of white fabric 36"x 36" square.
These squares must be folded into thirds both ways to form a square dressing. Example:



For combination dressing and bandages:
Make the tails 36-48 inches long and the width equal to the size of the dressing you are making. Place the dressing in the middle of the tail and stitch on each edge or down the middle of the square dressing.



For triangle bandages:
Cut a triangle 55" across the base and from 36-40 inches along the sides. These bandages will last longer if they have narrow hem. (There is no need to sterilize this bandage.)



Preparing for Sterilization

Bandages must be carefully wrapped in aluminum foil and protected from damage. They will remain sterile unless the foil is torn, punctured, or opened. The following are suggestions to minimize the amount of foil you might use:
For a 2" x 2" dressing, fold in half and place in a 4" x 4" piece of foil.
For a 3" x 3" dressing, fold in half and place in a 6" x 8" piece of foil.
For a 4" x 4" dressing, fold in thirds and place in a 6" x 7" piece of foil.
For a 6" x 6" dressing, fold in thirds one way and in half the other and place in an 8" x 8" piece of foil.
For a 12" x 12" dressing, fold in thirds both ways and place in a 12" x 12" piece of foil.
The combos will require a larger piece of foil.

Sterilization of Homemade Bandages

Place the wrapped dressings and combos in a pan or cookie sheet and bake at 350° for 3 hours. When cooled, store in a plastic bag for protection, keeping sizes separate for convenience. Label each dressing and combo. They may be labeled with just one number, if desired. For example: For a 2" x 2" bandage, label it 2. For a 2" x 2" combo, label 2C.

Surgical Instruments: With surgical instruments it is tempting to purchase the cheapest you can find. This approach is fine if you are anticipating only using them half a dozen times. After that the scissors will lose their edge and be impossible to sharpen, the needle holders will begin to let the needles twist, and the forceps ratchets keep slipping. Unfortunately, as with most things you get what you pay for. If you are preparing for a long-term scenario then you need to invest in good quality equipment, otherwise, they won't last the distance. Good quality instruments will last longer than you will. The top quality equipment is designed to be reused in a hospital several thousand times and still work well – this is more often than you will use them in a hundred years!

The other option is the manufacturing of instruments. A good metal worker will be able to create instruments to a high standard but it is very unlikely that they will ever match good quality pre-crash instruments. This also assumes that one will have access to a craftsman and a forge but it is potentially an option.

Many instruments can be improvised. Scalpel blades can be manufactured from thin pieces of steel – provided they can be sharpened to hold an edge. Dental extraction forceps can improvised from pliers. Many automotive tools are very similar to some medical instruments, and provided they are cleaned and sterilized may function well.

Suture material and needles: Most suture (particularly the non-absorbable) material will keep for a very long time. The ideal situation is to stock up in advance or scavenge. As with instruments it is likely a competent metal worker will be able to produce a reasonable range of suture needles.

"Gut" was the original surgical suture material. It is not exactly gut, it is the muscular layer stripped from the wall of the small bowel of sheep's intestines and preserved in alcohol. Cotton thread can be used both for skin suturing and internal sutures (even though it is not absorbable it can be left in place). It can be sterilized by wrapping it around a 1cm/0.5in rubber tubing and immersing in boiling water for 20 minutes, and used while it is still wet. Make sure the thread you use has a breaking strength of more than 1.5 kg/3 lbs by hanging an appropriate weight from a 10 cm/4 in long strand. If it doesn't bear the weight double or triple strands can be used. Avoid using this for interrupted sutures where possible.

Other equipment and supplies: The trick with improvising medical equipment is ingenuity. Always look at what you have and think, "What else can I do with this?"

For example, urethral catheters can be used as a catheter, or as a chest drain, or to control a severe bleeding nose, or as a cannula in an IV cutdown; a safety pin can pin bandages, open an airway by pinning the tongue to the lips, close a wound, remove a foreign body, or pop an abscess.

Many items of medical equipment have multiple uses some are a poor second choice to proper equipment, others do a first class job; the key is think broadly about possible uses.

It is also important to realize that you have a huge scope for do-it-yourself equipment.

Below is a list of just a couple of ideas for improvised equipment but it's just a starting point, there is vast potential:

Splints – For a fracture to heal it needs to be immobile, and comfortable, and not cause pressure points. Plaster of Paris and fiberglass have been used for most long term splinting for the last many decades. Splints can be manufactured from just about anything that can immobilize a fracture site. Wood, plastic, strips of material, spun wool all in various combinations can be used to construct an adequate splint for a limb. A perfectly workable traction splint can be improvised for a broken femur from fencing wire, duck tape, and some insulation foam.

Fly Trap – Flies are a major vector for disease transmission particularly for diarrhea disease. The key factor in reducing the number of flies is adequate waste disposal. But trapping can also have a significant impact on their numbers. Simple flytraps can be made with plastic soda bottles (of which there will be thousands around for years to come, regardless of what disasters may befall us – given their slow decomposition). However, these traps can collect thousands of flies which decompose slowly so you need to consider how you will dispose of them. Emptying the traps is one of the worst jobs on the planet. Details on their construction can be found at http://www.talcuk.org/free/html/flytrap/flytrap.htm

Asthma spacer – Moderate to severe asthma attacks are frequently treated with oxygen driven nebulizers which aerosolize the asthma medication and improve delivery of it to the lungs. Over the last few years volumetric spacers have started to replace nebulizers. These are small plastic cylinders with a mouth piece which the patient breathes in and out through. The medicine is sprayed into the chamber of the cylinder and the patient breathes it in. The concept is that if medication is delivered into a confined space it doesn't disperse so quickly so by having the patient breath in and out through the spacer more of the medicine is delivered to the lung. A perfectible useable Spacer can be made from a 2L plastic soft drink bottle; the patient breaths in and out through the mouth of the bottle, vent holes are cut in the base, and a hole for the inhaler to spray through on the side.

Chapter 7 Responder Lifestyle in an Austere Environment

Lifestyle
Prior to any disaster it is worth considering what you can do to improve your own and your team's health. Ensuring regular exercise, a good diet, maintaining a good weight, and that BP and cholesterol levels are monitored. Prevention of diseases such as heart disease, strokes, and diabetes is much better than attempting to treat them in an austere survival situation. You should ensure that all members of your team have their vaccinations up to date especially tetanus, measles, diphtheria, and polio.

Pacing Yourself
You will do your patient no good if you work to the point of exhaustion. Learn to sleep when your patient sleeps. Have someone else watch over the patient while you sleep if you can't arrange to sleep when your patient does. The helper can notify you of any emergency or other need such as pain medication.

Establish a routine. If the patient's condition is acute but not urgent and regular vital signs are called for set a schedule. A generally accepted standard is every 4 – 8 hours. For more serious cases whose condition may change regularly use the shorter interval, such as trauma cases or very acute illness. For a patient who is recovering usually every 8 hours is frequent enough unless there is an unexpected change, at which time you may want to reassess the current vital signs.

Look for shortcuts. Instead of placing the patient in bed fully clothed provide them with a modest cover. This facilitates faster access for dressing changes and elimination needs and also reduces the laundry load. Try arranging the schedule of care so that you can accomplish several tasks in one visit to the bedside. If caring for several patients at once schedule their care in blocks of time that allow progression from one individual to another once the bulk of the needed treatments have been completed.

Place a hand bell or other audible signaling device where the person can reach if it they need something. Arrange a pull cord so that a bell will ring when assistance is required. This will allow you to tend to other patients or even to spend much-needed time away from the treatment area without the patient lacking for attention when required.

Have a family member or friend sit with them and provide simple services such as adjusting bedding and pillows, or feeding them or assisting with simple tasks that do not require a trained caregiver.

Focus on effect and outcomes instead of perfect technique. For persons formally trained in nursing technique this may represent a major mental obstacle to overcome.

Lack of the tools and on-call resources that are routinely at our disposal in a modern, working healthcare system can be frustrating at best, and disabling if we dwell upon what we do not have versus what is available.

In providing nursing care in the austere environment we need to focus on the patient first and foremost. There should be no artificial schedules such as demanded by an institution. Your actions should be focused on the one or few patients under your care. The one overriding consideration that needs to be reinforced is this: model your care around which is necessary for the comfort and recovery of your patient(s) and not around any medical-legal model of what care should be for a given case. Base your actions on what is in the patient's best interests at all times. Do no harm, know what is harmful, and proceed accordingly.

Chapter 8 Public Health in an Austere Environment

Infectious Disease in an Austere Environment

In an austere medical facility an outbreak of an infectious disease could be its own disaster. Once you are established in a shelter or similar facility the introduction of new bacteria or viruses is likely only from an outside force ie new patient carrier. Outbreaks of infectious disease can occur after the incubation period for infections have passed. It is likely to occur due to 2 processes. Firstly from mutation of bacteria already in the body to a slightly different form, that is different enough to cause new infections.

Secondly by contamination of the environment with bacteria and virus which normally live in the gut. Prevention of the first is very difficult in a confined environment. Prevention of the second can be achieved with fastidious attention to hygiene particularly with hand washing and food preparation. Disinfectant hand-gels are very useful in situations where water may be rationed. One of the biggest sources of gut infections in disaster situations is the inability to adequately clean plates and cooking utensils. Hot water and detergent must be used when cleaning eating utensils

There is no clear evidence daily wiping down of all surfaces with a dilute disinfectant reduces infection.

Preventive Medicine

A large proportion of the disease burden in the past is related to poor public health and preventive medicine. For the most part it was related to ignorance of the role of bacteria in causing disease. Key elements of preventive medicine and infection control include:

- Hand washing – soap production is a priority
- Clean drinking water – uncontaminated by sewage and waste water
- Boil and filter water if purity not certain
- Sewage disposal – long drops or composting toilets and ensuring their drainage is not into the drinking water catchment
- Rubbish disposal – away from living areas, not draining into the drinking water catchment. Consider burying or burning what you can. Appropriate food waste into compost. You also need to consider how you will dispose of medical waste. Frequently this will be contaminated with blood and often infectious material. Incineration is probably the best option, followed by deep burial – away from water sources.
- Rodent and insect control – both are vectors for disease. Adequate rubbish disposal and trapping are probably the best methods for rodent control.

- Depending on climate mosquitoes may be a problem; stagnant water and rotting soft wood are foci for the mosquito larvae.

- Hygienic food preparation and storage – a large amount of food poisoning is a direct consequence of poor food handling and storage. Hand washing before any food handling.

- Isolation of anyone with a potentially infectious disease. Although many illnesses are infectious before symptoms become apparent it is important that any person who becomes unwell, particularly with fever or diarrhea, is isolated immediately in an attempt to minimize further infections.

With diarrheal illness – simple hand washing is usually sufficient for the caregiver.

With febrile illnesses or those with respiratory symptoms then barrier precautions should be used gloves, gown, facemask (N95), and goggles should be used. If this level of protection is not possible then some form of face mask is needed when with the patient and hand-washing, changing clothes (hot wash), and showering before contact with the healthy. For strangers arriving particularly during a pandemic consider 10-14 days isolation, followed by clothes burning and a through wash with soap before entering the community. There are no current infectious diseases with longer incubation times than 10-14 days. Provided the newcomer is symptom free at the end of this period you should be safe. This approach does not offer protection against those people who are carriers. However, among the current potential pandemic causes there are not currently carrier states although this needs to be considered.

The tsunami in southern Asia and later in Haiti a few years ago clearly demonstrates how quickly public health can break down. Despite widespread knowledge even in developing third world countries about the basic principles of public health and hygiene latrines have been dug next to water supplies, water wasn't being boiled, and in some places no effort was made to burn or dispose of rubbish, and it was just allowed to accumulate. While you can argue that some of this was due to "shell shock" from the disaster itself it just goes to show how the fundamentals can go out the window in a stressful situation.

Hand Washing

After an emergency, it can be difficult to find running water. However, it is still important to wash your hands to avoid illness. It is best to wash your hands with soap and water but when water is not available, you can use alcohol-based products made for washing hands. Below are some tips for washing your hands with soap and water and with alcohol-based products.

When should you wash your hands?

1. Before preparing or eating food.
2. After going to the bathroom.
3. After cleaning up a child who has gone to the bathroom.
4. When tending to someone who is sick.
5. After handling uncooked foods, particularly raw meat, poultry, or fish.
6. After blowing your nose, coughing, or sneezing.
7. After handling an animal or animal waste.

8. After handling garbage.
9. When treating a cut or wound.

Techniques for Hand Washing with Alcohol-Based Products
When hands are visibly soiled, they should be washed with soap and water when available. However, if soap and water are not available, use an alcohol-based product for washing your hands. When using an alcohol-based handrub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. Note that the volume needed to reduce the number of bacteria on hands varies by product.

Alcohol-based handrubs significantly reduce the number of microorganisms on skin, are fast acting, and cause less skin irritation.

Techniques for Hand Washing with Soap and Water:

Proper techniques to use when washing your hands with soap and water:

1. Place your hands together under water (warm water if possible).

2. Rub your hands together for at least 20 seconds (with soap if possible). Wash all surfaces thoroughly, including wrists, palms, backs of hands, fingers, and under the fingernails.

3. Clean the dirt from under your fingernails.

4. Rinse the soap from your hands.

5. Dry your hands completely with a clean towel if possible (this helps remove the germs). However, if towels are not available or if they are shared by many people, then it is acceptable to air dry your hands.

6. Pat your skin rather than rubbing to avoid chapping and cracking.

7. If you use a disposable towel, throw it in the trash so that no one else can get your germs.

When should an alcohol-based hand sanitizer be used?
Normally it should be used in between normal hand washing, when hands are not visibly soiled and when water is not available, and after all patient contact (in a healthcare facility). There are also situations in which alcohol based sanitizer is the best choice even over hand washing. These are emergency and other situations when immediate sanitizing of the hands is the most important issue.

How many times can alcohol-based sanitizer be used before washing hands?
Alcohol-based sanitizer can be used to disinfect hands whenever they are not visibly soiled and it can be used repeatedly. There is no need to wash your hands between uses unless they become visibly soiled or come in contact with blood borne pathogens or body fluids.

Does alcohol-based sanitizer kill the good and bad germs?
Yes, however, because alcohol-based sanitizer has no residual antimicrobial activity, the natural flora left in the skin will resurface and repopulate quickly on the skin.

Does alcohol-based sanitizer contribute to antimicrobial resistance?
Because alcohol evaporates completely, there is no alcohol left behind to promote adaptation. Alcohol has been used in healthcare for over 100 years with no adverse effects. There is no evidence that microorganisms adapt or become resistant to alcohol-based sanitizer. In fact, alcohol-based sanitizer is highly effective against the antibiotic-resistant microorganisms MRSA and VRE.

Water Purification
To disinfect small quantities of water (5 gallons or less) the following procedures are recommended:

- Boiling – safest method
  - Bring water to a rolling boil for at least 1 minute
  - Elevations above 6,500 feet, increase boiling time to at least 3 minutes
- Purification tablets
  - Available at most drug stores or camping supplies
  - Follow package directions
- Bleach
  - Use liquid household bleach (5.25% sodium hypochlorite). DO NOT USE any with perfumes or other ingredients.
  - Add bleach to water according to table below
  - Mix thoroughly and let stand for 30 minutes
- Iodine
  - Add iodine to water according to table below
  - Mix thoroughly and let stand for 30 minutes
- Filters
  - Use backpacking type filter and follow directions

How To Store Water

- Store water in plastic containers (heavy opaque plastic best) with tight fitting, screw-on caps.
- Mark the date on the container and store where it is cool and dark.
- Use within 1 year.
- Household bleach can be used to prevent bacterial growth. See directions above.

Recommendations For Water Rationing
If it is necessary to limit water consumption, the following amounts per person per day are recommended:

- Drinking and cooking: 1 gallon
- Personal cleanliness: 1 gallon
- Laundry and dishwashing: 2 gallons

A minimum of 2 gallons per person per day can be used if 4 gallons are not available.

CHLORINE BLEACH DILUTION TABLE FOR DISINFECTION OF LARGE VOLUMES OF WATER

EMERGENCY DISINFECTION

Amount of Water	Bleach		Iodine	
	Clear Water	Cloudy Water	Clear Water	Cloudy Water
1 quart	2 drops	4 drops	5 drops	10 drops
1 gallon	8 drops	16 drops	20 drops	½ tsp.
5 gallons	½ tsp.	1 tsp.	1 tsp.	2 tsp.

CHLORINE BLEACH DILUTION TABLE FOR DISINFECTION OF LARGE VOLUMES OF WATER

Amount of Water to be Treated	Parts Per Million (ppm) Available Chlorine Using **HOUSEHOLD LIQUID BLEACH** (5.25% Sodium Hypochlorite)				
	1	5	25	50	100
50 gal	1 tsp	1 oz	3.5 oz	6.5 oz	13 oz
100 gal	2 tsp	2 oz	6.5 oz	13 oz	26 oz
200 gal	1 tbl	3 oz	13 oz	26 oz	1 qt
500 gal	1.5 oz	6.5 oz	1 qt	2 qt	1 gal
1,000 gal	3 oz	13 oz	2 qt	1 gal	2 gal
2,000 gal	6 oz	26 oz	1 gal	2 gal	4 gal
5,000 gal	13 oz	2 qt	2.5 gal	5 gal	10 gal
10,000 gal	26 oz	1 gal	5 gal	10 gal	20 gal
25,000 gal	2 qt	2.5 gal	12.5 gal	25 gal	50 gal
50,000 gal	1 gal	5 gal	25 gal	50 gal	100 gal

USEFUL WATER CONVERSION FACTORS

1 drop = .05 ml
1 drop = .0017 oz
1 liter = .264 gallons
5 ml = 1 tsp
1 cu. Foot = .028 cu. Meter
3 teaspoons (tsp) = 1 tablespoon (tbsp)
1 cu. meter = 35.314 cu. Feet
2 tbsp = 1 ounce (oz)
Water Volume = 7.48 gallons/cu. Foot
8 oz = 1 cup
Weight of Water = 8.33 pounds/gallon

2 cups = 1 pint
1 acre = 43,560 sq. feet
2 pints = 1 quart
1 acre foot = 325,829 gallons
4 quarts = 1 gallon
1 part per million = 1 mg/liter

Solid Waste Disposal
In the event of a natural disaster, solid waste will require proper storage and disposal to prevent vector nuisances, odor problems or the contamination of food and water supplies.

Definitions
Refuse – All wastes except the liquid-carried wastes normally discharged to sewers (includes garbage and rubbish.)
Garbage – Only those wastes which will decay or "spoil." (May include small dead animals.)
Rubbish – All those wastes which will not decay or "spoil."
Combustible rubbish – Rubbish which can be destroyed by burning.
Non-Combustible Rubbish – Rubbish which cannot be destroyed by burning.
Leachate – Liquid derived from decomposed garbage and/or water that has been in contact with garbage.

First Priority Activities
Most solid wastes will be generated and accumulate at the mass feeding facilities, hospitals, mass care centers and other places where food service is provided. The storage and/or disposal of garbage will be of particular concern to public health officials because normal refuse collection services may be interrupted for a considerable period of time (from several days to several months).

1. Determine if the disposal sites are safe and able to accept waste. If necessary, establish transfer sites to accept waste.

2. When normal refuse collection service is not available:
   (a) Issue instructions which tell how refuse must be prepared for disposal.
   (b) Separate the garbage from the rubbish.
   (c) If possible, put all garbage in plastic garbage bags; tie the tops of the bags.
   (d) Store all full bags in water tight dumpsters or cans with tight fitting lids. The containers should be kept as clean as possible, particularly or organic material.
   (e) Keep all garbage (once bagged), medical stations and housing areas away from areas such as food service.
   (f) Assign individuals and vehicles to collect refuse daily if possible, from each point of origin. (These vehicles should not be subsequently used to haul food or ice.) Provide safety equipment such as gloves, heavy boots and dust masks, if possible.

(g) Remove all garbage to a sanitary landfill as soon as possible or, if using an emergency trench system as outlined below, bury daily.
(h) Every effort should be made to dispose of rubbish as soon as possible; however, rubbish may be set aside for disposal at a later date.
(i) Avoid any open dumping or garbage, if possible.
(j) Monitor on a daily basis for vector control, fire prevention and odor control.

3. As a last resort, onsite burial may be used as a means of garbage disposal.

The disposal site should be selected nearby in a dry area not close to any well, lake or stream (at least 100 feet lateral distance) and in an area where digging is not too difficult. Dig a trench, the length of the trench may be varied in proportion to the population served and the estimated length of time that the trench must be utilized. Additional trenches may be excavated as needed. If adding trenches, allow about six to ten feet of undisturbed soil between the trenches. If available, use a dragline, clamshell crane or backhoe to excavate the trenches. Dump the refuse in the trench, spread it out, then compact it or tamp it. At the end of the day, cover with six inches of soil and then compact to tamp thoroughly.

When the trench is filled to about a foot from the top of the ground, fill the rest of the trench with soil and compact or tamp it thoroughly. Then add additional soil to provide a mound over the trench which, when tamped, will divert rainwater from the trench. If available, use a caterpillar-type bulldozer or a compactor for spreading, compacting or covering. In the absence of heavy equipment for spreading or compacting, a narrower trench can be used by lengthening the distance out and by covering the refuse with hand shovels until such time as larger equipment becomes available.

4. Infectious waste from hospitals and first aid stations must receive special handling. It should be burned completely or buried separately from regular organic waste material and be covered with two to three feet of soil before being compacted.

5. Hazardous wastes are to be kept separate from regular solid wastes and disposed of as directed by a Hazardous Materials Specialist. These wastes may have to be stored for removal at a later date to an approved hazardous material disposal site or treatment facility. The Hazardous Materials Specialist may determine that some hazardous wastes can be safely neutralized and disposed of onsite.

Second Priority Activities

In the case of a natural disaster, routine collection of garbage and rubbish is most likely to be disrupted. Listed below are guidelines for interrupted garbage and rubbish disposal.

1. If garbage service is expected to resume on either an emergency or routine basis within one to two weeks of the disaster, proper storage of organic wastes will be necessary.

2. If garbage collection service is not expected to resume for two weeks or longer after the disaster, onsite disposal will be necessary.

a. Burial will be the usual means of garbage disposal.

b. If onsite disposal is deemed necessary, suitable disposal areas must be determined for each emergency facility, and manpower and/or equipment secured for the burial operations.

3. It will be up to logistics and or medical operations on duty at the facility to make the determination whether there are sufficient and adequate garbage bins, cans etc. onsite to allow garbage that has been stored in plastic garbage bags to be held for collection by regular garbage collection services or whether onsite trench disposal must be initiated.

4. Solid waste disposal by individual residents can easily be accomplished by burying the garbage. The only necessary tools are a pick and shovel. Disposal of refuse should be done in the following manner.

Garbage

Garbage should be stored in plastic garbage bags or wrapped in paper and stored in watertight containers which have tight fitting lids. The containers should be kept as clean as possible with care being taken to remove any organic material from the container bottom when the container is emptied. Until normal garbage collection service is restored, never store garbage longer than three to seven days. Flies have a very short breeding cycle and can take over a garbage container in a very short time, especially during warm weather. If possible, the garbage should be buried daily. For the homeowner, a small hole about three feet deep and three feet in diameter can be used. Each time the garbage is dumped, completely cover it with at least three inches of soil and tamp thoroughly. When the hole is filled to within one foot of the ground surface, fill to ground level with soil, tamping it thoroughly. Add more soil to form a small mound which, when tamped, will divert rainwater from the hole.

• Once the small kitchen garbage containers have been emptied for garbage storage and/or disposal, keep the garbage as far away as possible from the food service, medical stations and housing areas.

• Keep people from trying to salvage garbage consisting of foods which are discarded because the food was contaminated or spoiled.

• Guards or other security measures may be necessary to prevent looting of unsafe foods.

• Keep animals from disturbing buried or stored waste.

Combustible Rubbish

Use combustibles for fuel or burn daily, subject to Fire Department regulations.

Non-Combustible Rubbish

• If possible, and if water is not scarce, wash tin cans. Open both top and bottom of the cans, then mash them flat. Also wash glass containers.

• Store non-combustibles in available containers in open areas.

Liquid Waste / Sewage
Ensure the proper handling and disposal of human liquid waste/sewage in order to:

1. Prevent the spread of diseases caused by enteric and helminthic organisms;

2. Prevent contamination of domestic water supplies; and

3. Prevent degradation of surface and ground water quality.

Priority Activities

1. If there is a delay in the resumption of normal sewer services, the public must be given instructions on the construction of safe emergency toilet facilities, via:

(a) Handouts which show how to construct emergency toilet facilities; and
(b) Information on the proper method of construction and use of latrines, pail latrines, excreta bags etc., and disposal of waste from these facilities should be released through the agency public information officer to local newspaper, radio and television media.

2. In cases of flooding or sewage discharge into homes, households should be advised as to proper methods of cleaning and disinfection of floor and wall surfaces, via:

(a) Informational handouts; and
(b) Informational news releases from the public information officer.

Non-Commercial Chemical Toilet
To construct a non-commercial chemical toilet:

1. A 10 to 16 gallon galvanized iron garbage can or equivalent container can be used. The height of the seat should be 16" above the ground. This can be accomplished by burying the bottom of the container into the ground or a small platform may be built around it to provide this height seat.

2. Make a seat using lumber or other available material, or fasten cleats on the underside of a regular flush toilet seat to prevent the seat from slipping on the container. The construction must be fly tight.

3. Install fly tight cover on seat or install filler between regular seat cover and seat to exclude flies. Ideally, the seat cover should be self-closing.

4. Put 2½ gallons of water and ½ pound of caustic soda, lye or caustic potash in the can. Chloroben may be used as a deodorant in amounts recommended by manufacturer.

5. When the can is half full, or at the end of each day, it should be emptied and thoroughly cleaned. The contents should be emptied into an operating sewer for disposal.

If a sewer is not readily available, put this material in a trench deep enough to allow 2 feet of dirt cover. Then backfill the trench with soil to the ground surface, compact and mound over. Identify the disposal site with a sign reading "Caution – Covered Sewage (Chemical Toilet Wastes)."

6. Provision should be made for routine cleaning of seats.

7. Hand washing facilities should be provided if at all possible, at least by utilizing a bucket filled with a disinfectant solution.

8. Toilet tissue should be provided.

9. Privacy may be provided by canvas, vinyl plastic tarps, fiberglass panels or plywood panels, and shelter from the elements by tents or wood frame structures.

10. One chemical toilet should be provided for at least every 20-25 people at a given location. If possible, separate toilets should be provided for men and women.

Pail Latrines

1. When pits cannot be dug or are not feasible due to high water table, lack of digging tools or equipment, unsuitable soil conditions etc., the latrine box can be constructed with an openable hinged or removable back for placing pails under seats. (Note: In the event that pails are unavailable, rinsed 55-gallon drums, cut in half, with welded-on handles, are good substitutes.)

2. Pails must be removed and cleaned daily with waste material disposed of in a functioning sewer or special pit for burial with a minimum of a 12 inch soil covering.

3. Provision should be made for routine cleaning of seats.

4. Hand washing facilities should be provided if at all possible.

5. Toilet tissue should be provided.

6. Privacy may be provided by canvas, vinyl plastic tarps, fiberglass panels or plywood panels, and shelter from the elements by tents or wood frame structures.

7. The number of latrine units required is estimated at one seat for every 20-25 individuals.

SHARPS AND MEDICAL WASTE STORAGE AND DISPOSAL

General Information
• Always use Universal Precautions in the care of all patients
• Dispose of all regulated waste according to Wisconsin State Statutes
• Sharps waste is defined as a potentially contaminated item having rigid corners, edges or protuberances capable of cutting or piercing (e.g., syringes, needles, glass containers)
• If standard sharps containers are not available, acceptable alternatives include metal cans with lids or empty plastic soft drink and water bottles
Clinic Medical Waste Collection
• Sharps waste is to be placed immediately after use, in a red, rigid, puncture proof, sharps container or acceptable alternative listed above
• Sharps containers must be:
❖ Maintained at each nursing station within easy reach
❖ Kept upright and not allowed to overfill
❖ Considered full when container reaches 2/3 full or manufacturer full line
❖ Closed immediately (snapped, screwed, taped, or otherwise sealed) prior to removal or replacement
❖ Labeled with the words "sharps waste" or with the international biohazard symbol and the word **"BIOHAZARD"**
Accidents/Spills
• Sharps and contaminated broken glass or materials from biohazard container **ARE NEVER TO BE PICKED UP BY HAND – ALWAYS USE SCOOP AND BRUSH**
❖ Isolate area and have another employee stay at site
❖ Obtain Spill Kit and protective wear
❖ Put on gloves, mask, and eyewear
❖ Pick up items with scoop and brush
❖ Place into a **SHARPS CONTAINER** or acceptable alternative
❖ Remove and dispose of disposable personal protective equipment and clean up items in a biohazard Bag
❖ Wash hands with soap and water
Reporting of Accidents and Emergencies
• Report any and all such emergency occurrences to either the employer or the Safety Coordinator as soon as possible
Transporting Sharps Waste
• Sharps containers must be closed prior to transport from the area where used to the disposal area
• Wear protective gloves to seal and move these containers
Handling and Storage
• Place sharps containers into appropriate hard containers
• Container lids must be snapped shut
• Containers must be labeled **"BIOHAZARD"** on the lid and all four sides of container
• Door to biohazard storage room must remain locked at all times
• Insofar as possible, medical waste should be store in a cool location to reduce problems with odors
• Untreated medical waste **MUST NOT** be compacted
• If Medical Waste is to be stored for extended periods and in large quantities, a separate area should be established for this purpose. Double bagging of the waste or storage of bagged waste in leak-resistant container or berm should be done since the bags may be torn or ruptured.

Emergency Disposal of Untreated Medical Waste
• Normally disposing of untreated medical waste at a sanitary landfill is a violation of Wisconsin Laws and regulations
• In the event of a Mass Trauma/Casualty Disaster untreated medical waste should be buried in a separate excavation into the fill, recovered with the excavated garbage and immediately covered with **SIX** inches of compacted earth
• Burial location should be logged by the operator and reported to the local enforcement agency, usually the local Health Department so that it is not inadvertently exhumed in the future
Standard Treatment for SHARPS and MEDICAL Waste
• **Steam Sterilization:** Medial waste can be autoclaved for subsequent disposal as solid waste. Large autoclaves are called Retorts. They rely on electricity
• **Chemical Sterilization:** is rarely used as a principal means of medical waste treatment. Chemical sterilants are effective in cleaning up and disinfecting spills, and treating liquids such as lab cultures, prior to disposing of the wastes in the sanitary sewer.
• Disinfection of spills and contaminated surfaces may be accomplished with a one to ten dilution of household bleach (5% sodium hypochlorite)
STORAGE
Medical waste may be divided into two distinct components, "biohazardous waste" and "sharps waste," which have different storage requirements. Biohazardous waste may be laboratory waste, including microbiologic specimens, human surgery specimens ("pathology waste"), recognizable fluid blood or blood products, and the like. Because biohazardous waste is often much higher in moisture and therefore susceptible to putrescence and/or microbial growth, it must, under the law, be treated within seven days. Sharps waste is hypodermic needles and attached syringes or tubing, scalpels, pasteur pipettes. Sharps waste need only be collected when containers are full.
Under disaster conditions, collection and treatment of biohazardous waste should be a higher priority than collection of sharps waste, since there is a greater likelihood of exposure to pathogens
DISPOSAL
No person may dispose of infectious waste in a solid waste disposal facility unless the infectious waste has undergone infectious waste treatment and is otherwise managed according to s. NR 526.11. Infectious waste generators shall ensure that infectious waste generated by them has undergone infectious waste treatment before disposal
provides at least secondary treatment. Most health care providers dispose of some of their medical wastes via the sewer system. However if this is to be done permission must be received from the local wastewater treatment authority.
FIRST PRIORITY ACTIVITIES
• Identify the locations where medical wastes are being generated
❖ Survey the status of hospitals, clinics, casualty collection points that have been established under the County Emergency Plan, and other ad hoc treatment centers
❖ Survey the status of medical office complexes
• Verify the facilities' continuing ability to treat wastes onsite. Medical waste that cannot be treated promptly should be transported by approved means to locations where treatment and disposal can take place.
• Determine whether medical waste will be accumulating beyond the storage capacity of a facility
• Verify the integrity of the sewer system. Alternative methods of disposal of liquid medical waste must be chosen if adequate sewage treatment is not available. An intact sewage collection and treatment system may be utilized to accept liquid medical waste such as blood, drainage etc., thus reducing the volume of waste that would require transportation and disposal.
• Determine the condition of roads and highway system and evaluate the impact on medical waste collection and transportation
• Segregate sharps, chemotherapy wastes and liquids to help reduce bulk accumulation
• Increase medical waste collection/treatment to prevent accumulation

• If power and freezer space is available, consider freezing putrescible material
• Determine the availability of registered hazardous waste haulers who are authorized to transport medical waste if the normal medical waste haulers are not available. A list of haulers can be obtained from the State Department of Health Services, Environmental Health Division.
• Common, municipal solid waste haulers may substitute for non-functioning medical waste handling facilities and transporters but only as a last resort and then only under strict supervision
SECOND PRIORITY ACTIVITIES
• As the emergency continues, it is important to determine whether normal services will be reestablished promptly, or whether alternative procedures for storage, collection or treatment should be undertaken. Large quantities of stored medical waste may have accumulated at hospitals or other treatment sites.
• If medical waste is to be stored for extended periods and in large quantities, a separate area should be set aside for this purpose. Double bagging of the waste or storage of bagged waste in a leak-resistant container or berm should be done since the bags may be torn or ruptured.
• If possible, all medical waste should be stored in a cool location to reduce odor problems and decomposition, since storage time may be extensive
• The medical waste storage area should be designed to prevent the access of rodents or insects to the waste
• Untreated medical waste must not be compacted
• If the emergency disposal of untreated medical waste is necessary at a sanitary landfill (normally a violation of Wisconsin laws and regulations), it should be buried in a separate excavation into the fill, recovered with the excavated garbage and immediately covered with six inches of compacted earth. The burial location should be logged by the operator and reported to the local enforcement agency (usually the local Health Department) so that it is not inadvertently exhumed in the future
REFERENCES:
1. Hazardous Materials – How to Safely Handle and Dispose of Biohazardous Waste in the Physician's Office, Bachman, Ann, American Association of Physician Offices and Laboratories, Knoxville, TN
2. OSHA 2001 Manual for Medical and Dental Practices

Hazardous Materials Management

The unplanned release and improper disposal of hazardous materials will undoubtedly occur as a consequence of a major disaster. This section emphasizes the need to maintain personal safety if an incident is encountered, ensure the safety of the public, provide public education, accurately characterize the material and associated risk, and contact the appropriate emergency response agency to ensure the protection of public health and the environment.

Response to hazardous materials incidents should be limited to individuals who have received appropriate specialized training, are equipped with the necessary personal protective equipment (PPE) and are acting in according with their agency's procedures. The medical responder who has not received the First Responder Health and Safety Training mandated by 29 CFR 1910.120 should never enter any area where a hazardous materials release or suspected hazardous materials release has occurred. Specialized hazardous materials emergency response training is also very highly recommended before responding to a hazardous materials incident in a disaster.

Definitions

CHEMTREC: Chemical Transportation Emergency Center. Operated by the Chemical Manufacturers Association (CMA) to provide emergency information in case of a chemical emergency. Available 24 hours a day (800) 424-9300 to give specific information on a chemical. They will also contact the shipper and/or manufacturer for more detailed information and assistance.

Contamination Reduction Zone: (Also known as the Warm Zone.) The area where personnel and equipment exiting the Exclusion Zone are decontaminated. Is also a buffer area between the Exclusion Area and the Support Zone.

Decontamination: The removal of possible or actual contamination from people and equipment. Usually done in an area close to the contaminated area to prevent the spread of contamination and reduce damage or injury. Soaps and other decontamination solutions are sometimes used but copious amounts of clean water will work for most substances in an emergency.

Evacuation: Removal of persons from an area of "potential" hazardous material/chemical contamination. Normally no PPE is required. Removal of people from a contaminated area is referred to as "rescue" and should be done by trained personnel wearing PPE.

Exclusion Zone: (Also known as the Hot Zone or Contaminated Area.) The area where contamination is known to occur or will likely occur. All persons in this area should be wearing the proper PPE. Access is limited to only those who have a need to be in this zone. Exit is through the Contamination Reduction Zone (Warm Zone).

Hazardous Material: A substance that can threaten or harm people, the environment or property. Included in this definition are specific regulatory terms such as hazardous wastes, hazardous substances, toxic substances and hazardous chemicals.

National Response Center (NRC): A reporting and communication center for hazardous materials emergencies. It is located at Coast Guard Headquarters in Washington D.C. and can be reached at (800) 424-8802. Assistance from either the EPA and/or the Coast Guard can be requested through this number. In a major disaster even smaller incidents should be reported to the NRC if adequate local or state assistance is not available.

Support Zone: (Also known as the Cold Zone.) An area beyond the Warm Zone where there should be no contamination and it is safe for persons without PPE. The Command Post is located in the Support Zone. Often the Support Zone is marked or barricaded off to exclude the general public so that there is no interference with emergency workers.

Volatile Liquid: A liquid which at ambient temperature and pressure releases vapors (gases).

First Priority Activities

1. Identify possible locations for hazardous materials incidents based on the type of disaster.

2. Be aware of the possible health and safety hazards that can be present at a hazardous materials incident.

3. Implement procedures to assess and mitigate a hazardous materials incident.

4. Refer the incident to the appropriate response agency.

Second Priority Activities
Provide information and assistance to the public regarding the disposal of household hazardous wastes.

Identifying Possible Locations of Hazardous Materials Incidents

1. Types of failures that can release hazardous materials following disasters, especially earthquakes, include:
    - Building structural failures
    - Dislodging of asbestos or encapsulated asbestos
    - Underground pipeline breaks due to soil movement or flooding
    - Above-ground pipeline breaks
    - Above-ground storage tank failures
    - Sloshing from above-ground tanks with open tops
    - Containers falling from shelves
    - Industrial equipment failures
    - Highway failures, train derailments
    - Other types of transportation incidents
    - Major fires

2. Major facilities which store hazardous materials:
    - Trucking and transfer facilities
    - Oil and chemical refineries
    - Military installations
    - Food processing facilities
    - Farms and agriculture facilities
    - Electroplating and metal coating facilities
    - Manufacturing facilities such as plastics, drugs, petro-chemicals, electronics
    - Laboratories – commercial, university and college, high school and others

- Wholesale and retail paint, chemical, hardware, home improvement, swimming pool suppliers and nursery facilities

- Pest-control firms

HAZARDOUS MATERIALS CAN BE FOUND IN ALMOST ANY FACILITY. IF UNSURE, PRESUME THAT HAZARDOUS MATERIALS ARE PRESENT UNTIL PROVEN OTHERWISE.

POSSIBLE HEALTH AND SAFETY HAZARDS AT HAZARDOUS MATERIALS INCIDENTS

Be aware of the possible safety hazards that can occur at a hazardous materials incident. Examples of these hazards are:

- Fires and explosions – fire may produce decomposition byproducts that may be more toxic than the original material

- Flammable or combustible materials that may ignite if exposed to heat, sparks or open flames

- Containers may explode in heat or fire

- Reaction with fuels may be violent

- Runoff to sewer may cause a fire or explosive hazard

- Chemical exposures

- Oxygen-deficient atmosphere

- Confined spaces

- Ionizing radiation

- Biological hazards

- Electrical hazards

- Heat stress

- Cold exposure

- Noise exposure

Procedures to Assess and Mitigate A Hazardous Materials Incident

1. Initial assessment. The initial assessment of the site is based on information that is readily available or can be obtained rapidly to determine what hazards exist and if immediate protective measures are necessary.

2. Precautionary steps to take at a suspected hazardous materials incident. (Basic steps to be taken if you believe that there is a hazardous materials emergency.)

- Proceed with extreme caution. Remember personal safety is the most important consideration.
- Determine the wind direction. (A diagram/picture might be helpful here.)
- Stay upwind from the location of the incident and upgrade if liquid is flowing downhill.
- If possible, provide others with the safe direction of approach to the incident.
- Be alert for toxic signs sick people, birds falling, vapor clouds, dead insects, runoff, and odor.
- Look for exposure problems that threaten life, health, the environment, property and equipment.
- If possible, keep other people upwind and, if necessary, upgrade of the incident.
- Isolate the area as far as possible and deny entry.
- If the incident involves gas, dust or a volatile liquid, assume the material is moving and consider evacuation of surrounding and downwind areas.
- Look for placards, NFPA signs on buildings or labels on drums that indicate the presence of hazardous materials.

Call for Assistance

- Local response agency
- State of Wisconsin Emergency Management Duty Officer, (800) 943-0003
- National Response Center, (800) 424-8802
- US Environmental Protection Agency (Chicago), (312) 353-2000

- CHEMTREC, (800) 424-9300

DO NOT DO ANY OF THE FOLLOWING

- Allow public access
- Walk in spilled materials or otherwise contaminate skin, shoes, clothing, vehicle or equipment
- Allow vehicles to drive over the spill
- Allow anyone to eat, drink or smoke near the spill, or provide any source of ignition
- Use highway safety flames
- Walk into areas downwind of an incident involving gases or volatile liquids
- Attempt to rescue anyone in the hot zone without first donning PPE and without backup personnel in PPE.

CHEMICAL TERRORISM AGENTS AND SYNDROMES:
Watch for these signs and symptoms

Agents	Signs	Symptoms	Onset	Clinical Diagnostic Tests	Exposure Route and Treatment	Differential Diagnosis
Nerve Agents: Sarin (GB) Tabun (GA); Soman (GD); Cyclohex Sarin (GF); VX; Novichok agents, other Organophosphorus Compounds including carbamates and pesticides	Pinpoint pupils (miosis) Bronchoconstriction Respiratory arrest Hypersalivation Increased secretions Diarrhea Decreased memory, Concentration Loss of consciousness Seizures	Moderate exposure: Diffuse muscle cramping, runny nose, difficulty breathing, eye pain, dimming of vision, sweating, muscle tremors High exposure: The above plus sudden loss of consciousness, seizures, flaccid paralysis (late sign)	Aerosols: Seconds to minutes Liquids: minutes to hours	Red blood cell or serum cholinesterase (whole blood) Treat based on signs and symptoms; lab tests only for later confirmation	Atropine (2mg) IV; repeat q 5 minutes,titrate until effective, average dose 6 to >15mg - use IM in the field before IV access (establish airway for oxygenation) Pralidoxime chloride (2-PAMCI) 600-1800 mg IM or 1.0 g IV over 20-30 minutes (maximum 2 g IM or IV per hour) Additional doses of atropine and 2-PAMCI depending on severity Diazepam or lorazepam to prevent seizures if >4 mg atropine given Ventilatory support	Poisoning from organophosphate and carbamate pesticides may occur as a result of occupational exposure Cyanide poisoning Myasthenia gravis
Cyanides: Hydrogen cyanide (HCN), cyanogen chloride	Moderate exposure: Metabolic acidosis, venous blood- O2 level above normal, hypotension, "pink" skin color High exposure: Above signs plus coma, convulsions, cessation of respiration and heartbeat	Moderate exposure: Giddiness, palpitations Dizziness, nausea, vomiting, headache, eye irritation, increase in rate and depth of breathing (hyperventilation), drowsiness High exposure: Immediate loss of consciousness, convulsions and death within 1 to 15 minutes	Seconds to minutes	Bitter almond odor associated with patient suggests cyanide poisoning Metabolic acidosis Cyanide (blood) or Thiocyanate (blood or urine) levels Treat based on signs and symptoms; lab tests only for later confirmation	Inhalation, ingestion and dermal absorption 100% oxygen by face mask; intubation with 100% fiO² if indicated Amyl bitrite via inhalation, 1 ampule (0.2 mL) q5 minutes Sodium nitrite (300 mg IV over 5-10 minutes) and sodium thiosulfate (12.5 g IV) Additional sodium nitrite should be based on hemoglobin level and weight of patient	Similar CNS illness can result from: Industrial/occupational exposure to HCN and derivatives; carbon monoxide (CO) exposure from incomplete combustion of natural gas or petroleum fuels (exhaust fumes in enclosed areas); hydrogen sulfide (H²S) exposure from sewers, animal waste, industrial sources) Poisoning from nerve agents

Vesicants/Blister Agents: Sulfur mustard, lewisite, nitrogen mustard, mustard lewisite, phosgeneoxim	Skin erythema and blistering; watery, swollen eyes; upper airways sloughing with pulmonary edema; metabolic failure; neutropenia and sepsis (esp. sulfur mustard, late in course)	Burning, itching, or red skin Mucosal irritation (prominent tearing, and burning and redness of eyes) Shortness of breath Nausea and vomiting	Lewisite, minutes; sulfur mustard, hours to days	Often smell of garlic, horseradish, and/or mustard on body Oily droplets on skin from ambient sources Urine thiodiglycol Tissue biopsy	Inhalation and dermal absorption Mustard No antidote for lewisite and lewisite/mustard Mixtures: British Anti-Lewisite 9BAL or Dimercaprol) IM (rarely available) Thermal burn therapy; supportive care (respiratory support and eye care)	Diffuse skin exposure with irritants, such as caustics, sodium hydroxides, ammonia, etc., may cause similar syndromes. Sodium Hydroxide (NaOH) from trucking accidents
Pulmonary/ Choking Agents: Phosgene, chlorine, diphosgene, chloropicrin, oxides of nitrogen, sulfur dioxide	Pulmonary edema with some mucosal irritation (greater water solubility of agent = greater mucosal irritation) leading to ARDS or non-cardiogeneic pulmonary edema Pulmonary infiltrate	Shortness of breath Chest tightness Wheezing Laryngeal spasm Mucosal and dermal irritation and redness	1-24 hours (rarely up to 72 hours); May be asymptomatic period of hour	No tests available but history may help identify source and exposure characteristics (majority of incidents generating exposures to humans involve trucking with labels on vehicle)	Inhalation No antidote Management of secretions; O^2 therapy; consider high dose steroids to prevent pulmonary edema (demonstrated benefit only for oxides of nitrogen) Treat pulmonary edema with PEEP to maintain PO^2 above 60 mm Hg	Mucosal irritation, airway reactions, and deep lung effects depend on the specific agent, especially water solubility
Ricin (castor bean oil extract)	Clusters of acute lung or GI injury; circulatory collapse and shock, tracheobronchitis, pulmonary edema, necrotizing pneumonia	Ingestion: Nausea, diarrhea, vomiting, fever, abdominal pain Inhalation: chest tightness, coughing, weakness, nausea, fever	18-24 hours 8-26 hours	ELISA (from commercial laboratories) using respiratory secretions, serum, and direct tissue	Inhalation and Ingestion No antidote supportive care for ingestion: charcoal lavage	Tularemia, plague, and Q fever may cause similar syndromes, as may biological weapons and chemical weapon against such as Staphylococcal enterotoxin
T-2 mycotoxins: Fusarium, Myrotecium, Triuchoderma, Verticimonsoporim, Stachybotrys	Mucosal erythema and hemorrhage (intestinal necrosis) Red skin, blistering Increased salivation Pulmonary edema Seizures and coma Liver/renal dysfunction	Dermal and mucosal irritation; Blistering, necrosis Blurred vision, eye irritation, Tearing Nausea, vomiting, and diarrhea Ataxia coughing and dyspnea	2-4 hours	ELISA from commercial laboratories Gas chromatography/Mass Spectroscopy in Specialized laboratories	Inhalation and dermal contact No antidote Supportive care For ingestion: charcoal lavage Consider high dose steroids	

Modified from Chemical Terrorism General Guidance Pocket Guide, Employee Education System for the Office of Public Health and Environmental Hazards, Department of Veterans Affairs. October 2001.

UNIVERSAL PERSONAL PROTECTIVE EQUIPMENT (PPE)*	Notification Procedures	FOR MORE INFORMATION	UNIVERSAL DECONTAMINATION PROTOCOL	DETECTION OF OUTBREAKS
Level A: Maximum protection against vapor and liquids. Environment known to be immediately dangerous to life and health (harm occurs within 30 minutes). Fully encapsulating, chemical-resistant suit, chemically resistant gloves and boots, and a pressure-demand supplied air respirator (air hose) and escape self-contained breathing apparatus (SCBA) Level B: Minimum protection exposure to unknown hazards. Full respiratory protection is required but danger to skin/risk of dermal absorption from vapor is less. Agent not identified, or concentration not known to be safe (i.e., field decontamination or ambulatory setting). Nonencapsulating, splash-protective chemical resistant suit (splash suit), chemical resistant gloves and boots/shoes, and a pressure-demand supplied air respirator (air hose) and escape SCBA Level C: Until patient/victim decontamination completed. Organic vapor/P11 cartridge respriator or hood, nonencapsulating chemically-resistant (i.e., coated Tyvek) suit and gloves * Training required to properly and safely use PPE	1. First call the local Health Director; after hours contact local health Director via 911. 2. If criminal activity is suspected, call your local law enforcement and the FBI. 3. Alert local HAZMAT team via fire department at 911.	• Contact your local poison control center or National Poison Control 800-222-1222 • Contact your public health regional surveillance team • Contact your institution industrial hygienist or safety officer • Department of Justice Domestic Preparedness National Response Hotline 800-424-8802 • If you need further help in clinical diagnosis, call CDC Emergency Response 770-488-7100 • Review US Army Chemical Casualty Care handbook (http://ccc.apgea.army.mil)	1. Remove clothing quickly and seal in plastic impervious bags (save for authorities). Strongly recommended even if exposure only to vapor or aerosol agent. 2. Wash skin and shampoo with hypoallergenic liquid soap and copious tepid water in sequential steps of rinse, soap, rinse, wait one minute, then final additional rinse (20 minutes). 3. Latent response from cyanide or pulmonary agents do not require decontamination. 4. Decontamination wastewater may require special collection or treatment. (Discuss with local water authorities; notify local water authorities at the time of an event.) 5. Pure metals and strong corrosives require dry decontamination (i.e., gently brushing or vacuuming of larger particles) before water is applied. 6. Clean and decontaminate the healthcare facility according to the specific agent involved. http://www.bt.cdc.giv/Agent/Agentiilstchem.asp	Epidemiologic Strategies • A rapidly increasing disease Incidence • An unusual increase in the number of people seeking care, especially with neurologic, respiratory, dermal and/or gastrointestinal symptoms • Higher attack rate among persons who had attendance at similar activities or events (work site, convention, sports events) with either indoor or outdoor exposure. • Clusters of patients arriving from a single locale • Large numbers of rapidly fatal cases • Any patient presenting with symptoms and/or signs that suggest inhalation, ingestion, or dermal exposure to a toxic chemical agent.

CDC CATEGORY LISTING OF POTENTIAL BIOTERRORISM AGENTS

CATEGORY	DEFINITION	DISEASE ENTITY & CAUSATIVE ORGANISM
CATEGORY A	High Priority	Anthrax (Bacillus anthracis)
	Easily transmitted from person-to-person	Botulism (Clostridium botulinum toxin)
	High mortality rates	Plague (Yersinia pestis)
	Potential for major public health impact	Smallpox (Variola major)
	Can cause public panic/social disruption	Tularemia (Francisella tularensis)
	Requires special action for public health preparedness	Viral hemorrhagic fevers (Ebola, Marburg, Lassa, Machupo
CATEGORY B	Second highest priority	Brucellosis (Brucella spp.)
	Moderately easy to disseminate	Glanders (Burkholderia mallei)
	Moderate morbidity and low mortality rates	Melioidosis (Burkholderia pseudomallei)
	Specific diagnostics required	Psittacosis (Chlamydia psittaci)
	Enhanced disease surveillance	Q Fever (Coxiella burnettii)
		Typhus fever (Rickettsia prowazekii)
		Viral encephalitis (Venezuelan Equine Encephalitis, Eastern Equine Encephalitis, Western Equine Encephalitis)
		Toxins (Clostridium perfringens, Ricinus communis, Staph. aureus)
		Food Safety (Salmonella spp., E. coli 0157:H7)
		Water Safety (Vibrio cholerae, Cryptosporidium parvum)
CATEGORY C	Third highest priority	Nipah (Nipah virus)
	Emerging pathogens	Emerging pathogens Hantavirus (Hantavirus)
	Could be engineered for mass dissemination	
	Available	
	Easy production and dissemination	
	Potentially high morbidity and mortality	
	Major health impact	

OTHER IMPORTANT EMERGING DISEASES

Transmissible Spongiform Encephalopathy (Bovine Spongiform Encephalopathy, New Variant Creutzfeldt-Jakob Disease, Scrapie)	Rift Valley Fever Virus
Hendra Virus	West Nile Fever (West Nile virus)
Sudden Acute Respiratory Syndrome (SARS)	Pandemic Influenza

BIOTERRORISM AGENTS

Disease	Signs & Symptoms	Incubation Time (Range)	Person to Person Transmission	Isolation	Diagnosis	Postexposure Prohylaxis For Adults	Treatment For Adults
Anthrax Bacillus anthracis Inhalation	Flu-like symptoms (fever, fatigue, muscle aches, dyspnea, nonproductive cough, headache), chest pain; possible 1-2 day improvement then rapid respiratory failure and shock. Meningitis may develop.	1-6 days (up to 6 weeks)	None	Standard Precautions	Chest x-ray evidence of widening mediastinum; obtain sputum and blood culture. Sensitivity and specificity of nasal swabs unknown –do not rely on for diagnosis Peripheral blood smear may demonstrate gram positive bacilli on unspun smear with sepsis. Culture blood and stool	Prophylaxis for 60 days Ciprofloxacin 500 mg PO q 12h Or Doxycycline 100 mg PO q 12h Alternative (If strain susceptible and above contraindicated): Amoxicillin 500 mg PO q 8h In vitro studies suggested that Levofloxacin 500 mg PO q 24h Or Gatifloxacin 400 mg PO q 24h Or Moxifloxacin 400 mg POq 24h could be substituted Recommendation same for pregnant women and immunocompromised persons	**Inhalation Anthrax** Combined IV/PO therapy for 60d Ciprofloxacin 500 mg q 12h Or Doxycycline 100 mg q 12h AND 1 or 2 additional drugs (vancomycin, rifampin, imipenem clindamycin, chloramphenocol clarithromycin, and if susceptible penicillin or ampicillin **Cutaneous Anthrax** Ciprofloxacin 500 mg PO q 12h Or Doxycycline 100 mg PO q 12h Recommendation same for pregnant women and immuno-compromised person
Cutaneous	Intense itching followed by painless papular lesions, then vesicular lesions, developing into eschar surrounded by edema.	1-12 days	Direct contact with skin lesions may result in cutaneous infection	Standard & Contact Precautions			
Gastrointestina	Abdominal pain, nausea and vomiting, severe diarrhea, GI bleeding, and fever.	1-7 days	None	Standard Precautions			
Botulism Botulinum toxin	Afebrile, excess mucus in throat, dysphagia, dry mouth and throat, dizziness, then difficulty moving eyes, mild pupillary dilations and nystagmus,intermittent ptosis, indistinct speech, unsteady gait, extreme symmetric descending weakness, flaccid paralysis; generally normal mental status.	Inhalation: 12-80 hours Food borne: 12-72 hours (2-8 days	None	Standard Precautions	Laboratory tests available from CDC or Public Health Dept; obtain serum, stool, gastric aspirate and suspect foods prior to administering antitoxin. Differential diagnosis includes polio, Guillain Barre, myasthenia, tick paralysis, CVA, meningococcal meningitis	Pentavalent toxoid (types A, B, C, D, E) 0.5 ml SQ may be available as investigational product from USAMRIISD.	Botulism antitoxins from public health authorities. Supportive care and ventilatory support. Avoid clindamycin and aminoglycosides.

BIOTERRORISM AGENTS

Disease	**Signs & Symptoms**	**Incubation Time (Range)**	Person-To Person Transmission	**Isolation**	**Diagnosis**	**Postexposure Prohylaxis For Adults**	**Treatment For Adults**
Pneumonia Plague	High fever, cough, hemoptysis, chest pain, nausea and vomiting, headache. Advanceddisease: purpuric skin lesions, copious watery or purulent sputum production; respiratory failure in 1-6 days.	2-3 days (2-6 days)	Droplet aerosols	Standard Precautions; Droplet Precautions until 48 hrs of effective antibiotic therapy	A presumptive diagnosis may be made by Gram, Wayson nor Wright stain of lymph node aspirates, sputum, or cerebrospinal fluid with gram negative bacilli with bipolar (safety pin) staining.	Doxycycline 100 mg PO q 12h Or Ciprofloxacin 500 mg PO q 12h	Streptomycin 1 gm IM q 12h Or Gentamicin 2 mg/kg, then 1.0 to 1.7 mg/kg IV q 8h Alternatives: Doxycycline 200 mg PO load, then 100 mg PO q 12h Or Ciprofloxacin 400 mg IV q 12h
Smallpox Variola Virus	Prodromal period: malaise, fever, rigors, vomiting, headache, and backache. After 2-4 days, skin lesions appear and progress uniformly from macules to papules to vesicles and pustules, mostly on face, neck, palms, soles, and subsequently progress to trunk.	12-14 days (7-17 days)	Airborne droplet nuclei or direct contact with skin lesions or secretions until all scabs separate and fall off (3-4 weeks)	Standard Precautions; Airborne Precautions (includes N95 mask); and Contact Precautions	Swab culture of vesicular fluid or scab, send to BL-4 laboratory. All lesions similar in appearance and develop synchronously as opposed to chickenpox. Electron microscopy can differentiate variola virus from varicell	Early vaccine critical (in less than 4 days). Call CDC for vaccinia. Vaccinia immune globulin in special cases – call USAMRIID 301-619-2833.	Supportive care. Previous vaccination against smallpox does not confer lifelong immunity. Revaccination every 5 years. Potential role for Cidofovir.
Tularemia Francisella Tularensis	Sudden fever, chills, headache, muscle aches, joint pain, progressive weakness, dry cough with pneumonia, chest pain, bloody sputum, dyspnea or apnea. Can be fatal if not treated with appropriate antibiotics.	3-5 days (3-14 days)	None	Standard Precautions	Presumptive diagnosis made through elevated serum antibody titer(s) to F. tularensis antigen in a patient with no history of tularemia vaccination Or detection of F. tularensis in a clinical specimen by fluorescent assay Confirmatory diagnosis by isolation of F. tularensis is a clinical specimen Or fourfold or greater change in serum antibody titer to F. tularensis antigen	Doxycycline 100 mg PO q 12h for 14 days Or Ciprofloxacin 500 mg PO q 12h for 14 days	Streptomycin 7.5-10 mg/kg IM bid for 10-14 days Or Gentamicin 3-5 mg/kg/d IV for 10-14 days Or Ciprofloxacin 400 mg IV q 12h for 10-12 days Or Ciprofloxacin 750 mg PO q 12h for 10-14 days
Viral Hemorrhagic Fevers e.g., Ebola fever, Lassa fever, Hantavirus pulmonary syndrome, hemorrhagic fever with renal syndrome; dengue fever; yellow fever; Marburg and	Hemorrhage under the skin, in internal organs, or from body orifices (mouth, eyes, ears); marked fever, fatigue, dizziness, muscle aches, loss of strength and exhaustion, cough, vomiting, diarrhea; severely ill patients may show signs of shock, nervous system malfunction, coma, delirium, seizures, and some have renal failure	2 days to 3 weeks depending on etiology	Direct contact with urine, fecal matter, saliva, or other body excretions Airborne for respiratoy symptoms	Standard Precautions; Contact Precautions; Airborne Precautions for people with respiratory symptoms	Laboratory tests of 10-12 ml of serum; tissue for immunohistochemitry tissue for PCR/virus isolation for identification of specific virus	Vaccines are developed for yellow fever and Argentine hemorrhagic fever, but no other viral hemorrhagic fever	No cure or established drug treatment. Patients are treated through aggressive supportive care and management of hypotension References: CDC – Centers For Disease Control And Prevention USAMRIID's Medical Management Of Biological Casualties Handbook North Carolina Statewide Program For Infection Control And Epidemiology

Congo-Crimean hemorrhagic fe							(SPICE

Patient Management Negative Pressure Rooms Are: Important Phone Numbers: Infectious Diseases_____-_____ Infection Control _____ _____ ER_____-_____ USAMRIID 301-619-2833, CDC Emergency Response Office 770-488-7100	**Bacterial Agent**	**Anthrax**	**Brucellosis**	**Cholera**	**Glanders**	**Bubonic Plague**	**Pneumonic Plague**	**Tularemia**	**Q Fever**	**Viruses**	**Smallpox**	**Venez. Equine Encephalitis**	**Viral Encephalitis**	**Viral Hemorrhagic Fever**	**Biological Toxins**	**Botulism**	**Ricin**	**T-2 Mycotoxins**	**Staph. Enterotoxin B**
Isolation Precautions																			
Standard Precautions for all aspects of patient care		X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X
Contact Precautions (gown & gloves; wash hands after each pt encounter)				X	X	X					X			X				X	
Airborne Precautions (negative pressure room & N95 masks for all individuals entering the room)											X			X					
Droplet Precautions (surgical mask)							X							X					
Patient Placement																			
No restrictions		X	X	X	X			X	X			X	X			X	X	X	X
Cohort like patients when private room unavailable				X	X	X	X				X			X				X	
Private Room				X	X	X	X				X			X				X	
Negative Pressure											X			X					
Door closed at all times											X			X					
Patient Transport																			
No restrictions		X	X	X	X	X		X	X			X	X			X	X	X	X
Limit movement to essential medical purposes only				X	X	X	X				X			X				X	
Place mask on patient to minimize dispersal of droplets											X			X					
Cleaning and Disinfection																			
Routine cleaning of room with hospital approved disinfectant		X	X	X	X	X	X	X	X		X	X	X			X	X	X	X
Disinfect surfaces with 10% bleach solution or phenolic disinfectant														X					
Dedicated equipment (disinfect prior to leaving room)				X	X	X					X			X				X	
Linen management as with all other patients		X	X	X	X	X	X	X				X	X	X		X	X	X	X
Linens autoclaved before laundering in hot water with bleach added											X								
Post-mortem Care																			
Follow principles of Standard Precautions		X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X
Droplet Precautions (surgical mask)							X												
Contact Precautions (gown & gloves)					X	X					X			X				X	
Avoid autopsy or use Airborne Precautions & HEPA filter							X				X			X					
Routine terminal cleaning of room with hospital approved disinfectant		X	X	X	X	X	X	X	X		X	X	X			X	X	X	X
Disinfect surfaces with 10% bleach solution or phenolic disinfectant														X					
Minimal handling of body; seal body in leaf-proof material														X					
Cremate body whenever possible											X								
Discontinuation of Isolation																			
48 hrs of appropriate antibiotic and clinical improvement							X												
Until all scabs separate											X								
Until skin decontamination completed (1 hr contact time)																		X	
Duration of illness				X	X	X								X					

STANDARD PRECAUTIONS - Standard Precautions prevent direct contact with all body fluids (including blood), secretions, excretions, non-intact skin (including rashes) and mucous membranes. Standard Precautions routinely practiced by healthcare providers include: splash/spray, and gowns to protect skin and clothing during procedures.

xContact precautions needed only if the patient has skin involvement (bubonic plague: draining bubo) or until decontamination of skin is complete (T2 Mycotoxins).
xxA surgical mask and eye protection should be worn if you come within 3 feet of pt. Airborne precautions are needed if patient has cough, vomiting, diarrhea or hemorrhage.
xxx Contact precautions needed only if the patient is diapered or incontinent

QUARANTINE AND ISOLATION FOR POTENTIAL CAUSATIVE AGENT/DISEASE ENTITY

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Anthrax (Inhalation) Bacillis anthracis Category A	Respiratory Syndrome Neurological Syndrome	1 to 7 days, (up to 6 weeks)	None Articles and soil contaminated with spores may remain infective for decades.	Standard precautions for the duration of illness.	None
Anthrax (Cutaneous) Bacillis anthracis Category A	Cutaneous Syndrome Cutaneous Ulcer & Ulceroglandular Syndrome	1 to 12 days	Direct contact with skin lesions may result in cutaneous infection.	Standard precautions for the duration of illness. B. Contact precautions Antibiotic therapy sterilizes a skin lesion within 24 hours	None
Anthrax (Gastrointestinal) Bacillis anthracis Category A	Gastrointestinal Syndrome	1 to 7 days	None	Standard precautions	None
Botulism (Inhalation) Botulinum toxin Category A	Neurological Syndrome	12-80 hours	None	Standard precautions	None
Botulism (Foodborne) Botulinum toxin Category A	Neurological Syndrome	12-72 hours (2-8 days)	None	Standard precautions	None
Brucellosis (Undulant fever, Malta fever, Mediterranean fever) Brucella abortus, B. melitensis, B. suis and B.canis Category B	"Influenza-like" Syndrome	5-60 days	Only if there is direct exposure to infected body fluids.	Standard precautions if there are draining lesions	None
Food Safety Category B					
• **E. coli 0157:H7** Enterohemorrhagic Category B	Gastrointestinal Syndrome	3-4 days (2-8 days)	Fecal oral route between humans. Ingestion of food or water contaminated by cattle.	Standard precautions Enteric precautions Infected people should not be food handlers or provide child or patient care until 2 successive negative fecal samples or rectal swabs obtained no less than 24 hours apart.	None
Salmonella spp. Category B	Gastrointestinal Syndrome	12-36 hours (6-72 hours)	Fecal oral route between humans. Ingestion of contaminated poultry, swine, cattle, rodents, iguanas, tortoises, turtles, terrapins, dogs, cats.	Standard precautions Enteric precautions Infected people should not be food handlers or provide child or patient care until 2 successive negative fecal samples or rectal swabs obtained no less than 24 hours apart.	None
Glanders Burkholderia mallei Category B	Respiratory Syndrome Cutaneous Syndrome	1-14 days	Rare person-to-person transmission – close contact. Direct exposure to infected horses, mules and donkeys.	Standard precautions Contact precautions indicated for those with cutaneous involvement	None

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Hantavirus Pulmonary Syndrome HPS Hantavirus Category C	Respiratory Syndrome	Not clearly defined Approximately 2 weeks (few days to 6 weeks)	Rare person-to-person transmission. Usually transmitted by infected rodents through urine, droppings, saliva Humans contract through aerosolized virus.	Standard precautions Airborne precautions Contact precautions	None
Melioidosis Burkholderia pseudomallei Whitmore Disease Category B	Respiratory Syndrome	2 days to years Rare person-to-person transmission.	Usually contact with infected soil or water or inhalation of dust from infected sheep, goats, horses, swine, monkeys rodents and birds.	Standard precautions	None
Nipah Nipah virus Category C	Respiratory Syndrome Neurological Syndrome	4-18 days	No evidence of person to person transmission. Direct contact with infected swine.	Standard precautions	None
Pneumonic Plague Yersinis pestis Category A	Respiratory Syndrome	2-3 days – may be a few days longer in immunized (2-6 days)	Droplet aerosols or the bite of infected rodent fleas.	Standard precautions Droplet precautions until 48 hours of effective antibiotic therapy.	Household or face to face contact should be provided chemoprophylaxis and placed under surveillance for 7 days; Those refusing chemoprophylaxis - maintain in strict isolation & surveillance for 7 days.
Q Fever (Query fever) Coxiella burnetii Category B	"Influenza-like" Syndrome	Usually 2-3 weeks Depends on size of dose	Rarely occurs. Occurs in sheep, cattle, goats, cats, dogs some wild animals, bird and ticks. Contaminated clothing may be a source of infection or tick bites.	Standard precautions	None
Smallpox Variola Virus Category A	"Influenza-like" Syndrome Cutaneous Syndrome	12-14 days (7-17 days)	Airborne droplet nuclei or direct contact with skin lesions or secretions until all scabs separate and fall off (3-4 weeks). Standard precautions Droplet precautions Airborne precautions (includes N95 mask)	Contact precautions	Strict quarantine of asymptomatic contacts initiated according to CDC and Department of Community Health guidelines and at the Health Officer's discretion.

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Toxins **Category B**					
• **Clostridium** Perfringens	Gastrointestinal Syndrome	10-12 hours (6-24 hours)	No person to person transmission. Transmitted through ingestion of food contaminated by soil or feces that contains the organism.	Standard precautions	None
• **Ricin** (Inhalational) Ricinus communis	Respiratory Syndrome	Onset 8-36 hours	Avoid all contact Strict hygiene May adhere to skin or clothing and passed on • Remove clothing • Avoid contact with eyes • Wash soap/water • Dispose of clothing May be ingested through food and water.	Prior to decontamination use pressure demand, self-contained breathing apparatus. Do not eat or drink in contaminated area. Wash hands thoroughly before eating Tychem® BR or Responder® CSM protective clothing. Goggles with respiratory protection or full face-piece respirator.	Quarantine affected area
• **Ricin**(Gastrointestinal) Ricinus communis	Gastrointestinal Syndrome	Onset 18-24 hours			
• **Ricin (**Cutaneous) Ricinus communis	Cutaneous Syndrome	Within hours			
• **Staphylococcal** enterotoxin B Staphylococcal aureus	Respiratory Syndrome Gastrointestinal Syndrome	1-6 hours	None	Standard precautions	None
• **Tularemia** Francisella tularensis Category A	"Influenza-like" Syndrome Respiratory Syndrome	3-5 days (3-14 days)	None	Standard precautions	None
• **Typhus fever** Rickettsia prowazekii Category B	"Influenza-like" Syndrome Cutaneous Syndrome	12 days (1-2 weeks)	Transmitted from person to person by body louse or inhalation of infected body louse feces	Standard precautions Not required after proper delousing of patient, clothing, living quarters and household contacts	Louse infested susceptibles exposed to typhus fever ordinarily should be quarantined for 15 days after application of an insecticide with residual effect
Viral Encephalitis **Category B**					
• **Eastern Equine Encephalitis** (mainly eastern and north central USA and adjacent Canada)	Neurological Syndrome	5-15 days	Transmitted from infected horses and swine through the bite of mosquitoes	Standard precautions Enteric precautions are appropriate until enterovirus meningoencephalitis is ruled out.	None

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Western Equine Encephalitis (western and central USA, Canada and parts of South America)	Neurological Syndrome	5-15 days	Transmitted from infected horses and swine through the bite of mosquitoes	Standard precautions Enteric precautions are appropriate until enterovirus meningoencephalitis is ruled out.	None
Venezuelan Equine Encephalitis	"Influenza-like" Syndrome Neurological Syndrome	2-6 days (as short as 1 day)	Transmitted from infected horses and rodents through the bite of mosquitoes .	Standard precautions Keep patient in a screened room or in quarters treated with an insecticide for at least 5 days after onset or until afebrile	None
Viral Hemorrhagic Fevers Category A					
Ebola fever Category A	"Influenza-like" Syndrome Neurological Syndrome Cutaneous Syndrome	2-21 days	Person to person transmission occurs by direct contact with infected blood, secretions, organs or semen. Risk highest during the late stages when patient is vomiting.	Standard precautions Contact precautions (Includes mask and goggles for those within 3 feet of patient) Strict restrictions of sexual intercourse for 3 months or until semen can be shown to be free of virus	Surveillance recommended for close contacts. Body temperature checks 2 times a day at least 3 weeks from last exposure. Temperature > 38.3°C (101°F), hospitalize in strict isolation.
Marburg Category A	"Influenza-like" Syndrome Neurological Syndrome Cutaneous Syndrome	3-9 days	Person to person transmission occurs by direct contact with infected blood, secretions, organs or semen. Risk highest during the late stages when patient is vomiting.	Standard precautions Contact precautions (Includes mask and goggles for those within 3 feet of patient) Strict restrictions of sexual intercourse for 3 months or until semen can be shown to be free of virus.	Surveillance recommended for close contacts. Body temperature checks 2 times a day at least 3 weeks from last exposure. Temperature > 38.3°C (101°F), hospitalize in strict isolation.
Lassa fever Category A	"Influenza-like" Syndrome Neurological Syndrome	6-21 days	Person to person transmission occurs during acute febrile phase when virus is present in throat. Also in urine. Transmission primarily through aerosol or direct contact with excreta of infected rodents.	Standard precautions Contact precautions (Includes mask and goggles for those within 3 feet of patient) Airborne precautions Strict restrictions of sexual intercourse for 3 months or until semen can be shown to be free of virus.	Surveillance recommended for close contacts. Body temperature checks 2 times a day at least 3 weeks from last exposure. Temperature > 38.3°C (101°F), hospitalize in strict isolation.

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Machupo Category A	"Influenza-like" Syndrome Neurological Syndrome Cutaneous Syndrome	7-16 days	Occasional direct transmission from person to person. Primarily transmitted through inhalation of small particle aerosols derived from infected rodent excreta.	Standard precautions Contact precautions (Includes mask and goggles for those within 3 feet of patient) Airborne precautions may be desirable	None
Water Safety **Category B**					
Cryptosporidiosis Cryptosporidium parvum	Gastrointestinal Syndrome	7 days (1-12 days)	Fecal-oral route includes person to person, animal to person, waterborne, and foodborne transmission through an infected parasite	Standard precautions Enteric precautions in handling feces, vomitus and contaminated clothing and bed linen. Infected people should not be food handlers or provide child or patient care until asymptomatic. Teach proper hand hygiene	None
Cholera Vibrio cholerae	Gastrointestinal Syndrome	2-3 days (Usually a few hours to 5 days)	Person to person transmission through ingestion of food or water contaminated directly or indirectly with feces or vomitus of infected persons. Person communicable as long as stools are positive (usually a few days after recovery), but a carrier state may persist several months. Ingestion of raw or inadequately cooked seafood.	Standard precautions Enteric precautions Teach proper hand hygiene and fly control.	None Surveillance of persons who shared food and drink with a cholera patient for 5 days from last exposure

POTENTIAL AGENT DISEASE ENTITY	SYNDROME(S)	INCUBATION PERIOD (RANGE)	PERSON TO PERSON TRANSMISSION	INDIVIDUAL/COMMUNITY CONTAINMENT	
				ISOLATION	QUARANTINE
Other Important Diseases No Category Listing					
Hendra virus	Respiratory Syndrome Neurological Syndrome	4-18 days (up to 3 months)	No evidence of person to person transmission. Direct contact with infected horses.	Standard precautions	None
Rift Valley Fever Virus	"Influenza-like" Syndrome Neurological Syndrome	3-12 days	Not directly transmitted from person to person. Transmitted by infected mosquitoes or by butchering infected animals.	Standard precautions	None
SARS (Severe Acute Respiratory Syndrome)	"Influenza-like" Syndrome Respiratory Syndrome	2-7 days (as long as 10days)	Person to person transmission is through close contact (household, kissing, embracing, using eating/drinking utensils, conversing within 3 feet, etc.).	Standard precautions Airborne precautions Droplet precautions	Initiated according to CDC and Department of Community Health guidelines and at the Health Officer's discretion.
Transmissible Spongiform Encephalopathy (BSE, CWD, Kuru, Scrapie, "Mad Cow Disease")	Neurological Syndrome	15 months to possibly more than 30 years	Some transmissibility to humans through the consumption of CNS tissue of cattle infected with BSE. Avoid using tissue from infected patients in transplants or instruments contaminated through use on an infected patient.	Standard precautions	None
West Nile Virus	"Influenza-like" Syndrome Neurological Syndrome	3-14 days	Not transmitted from person to person. Transmitted from the bite of a mosquito that has bitten a infected birds, horses, cats, bats, chipmunks, skunks, squirrels and rabbits.	Standard precautions Keep patient in a screened room or in quarters treated with an insecticide for at least 5 days after onset or until afebrile. Blood of RVF patients may be infectious	None

Nuclear and Radiation Exposure

Background Information

- Radiation:
  1. Cannot be seen, heard or smelled.

  2. Can travel up and down, upwind and downwind (if possible, stay uphill and upwind direction).

  3. Can be detected only with special instruments.

- Radiation is classified as non-ionizing or ionizing:
  - **Non-ionizing radiation:**
    1. Is usually far less hazardous.

    2. Examples are visible light, radio waves and x-rays.

  - **Ionizing radiation:**
    1. Is more chemically active and will damage cells.

    2. Signs of acute radiation poisoning are hair loss, GI problems, bone marrow/blood changes, and sterility.

  3. Alpha, beta and gamma are three types of ionizing radiation:
     (a) **Alpha particles** do not travel very far and are usually only hazardous if ingested in the body, inhaled, or entered through contamination of an open wound.
     (b) **Beta particles** can travel greater distances, can penetrate the skin and can cause skin burns, may be ingested or inhaled, and require special protective clothing to provide protection.
     (c) **Gamma radiation** is very strong energy, can travel long distances at the speed of light and can go through objects. Requires thick barriers of lead, concrete or soil to provide protection.

Radiation Exposure vs. Contamination

Exposure – A measure of ionization in air caused by x-rays or gamma rays only. A person who has been exposed to radiation has had radioactive waves or particles that penetrate the body (e.g., x-ray) have been exposed, but are not necessarily contaminated. External exposure is further classified as partial body and total body irradiation.

Contamination – The deposition of unwanted radioactive material on the surfaces of structures, areas objects, or people where it may be external or internal. A contaminated person has been exposed to radiation release by radioactive material on or inside the body. An uncontaminated person can be exposed by being too close to radioactive material or a contaminated person, place, or thing.

Internal contamination occurs when people swallow or breathe in radioactive materials, or when radioactive materials enter the body through an open wound or are absorbed through the skin. Some types of radioactive materials stay in the body in different organs and others are eliminated from the body in blood, sweat, urine, and feces.

External contamination occurs when radioactive material, in the form of dust, powder, or liquid, comes into contact with a person's skin, hair, or clothing. People who are externally contaminated can become internally contaminated if radioactive material gets into their bodies.

Units:
The common radiation units used to define radiation exposure for many years have been the R (Roentgen), the Rad and the Rem. The R represents the exposure in air presented to the patient. The Rad represents the absorbed dose of radiation in tissue and the Rem represents the Rad equivalent in man. It is a unit that equates the absorbed dose (Rad) from all the different types of radiation (alpha, beta, gamma and x-ray) to a common biological effect.

New units are being phased in to replace the Rad and the Rem. They are Gray (Gy) and the Sievert (Sv). 1 Gy =100 Rad; 10 Gy = 1000 mRad; 1 Sv = 100 Rem and 10 mSv = 1000 mRem.

Partial Body External Exposure
The doses required are quite large and result from brief exposures.

Local Skin Exposures1

Condition	mRem	mSv	Rem	Sv
Erythema	600,000	6,000	600	6
Dry Desquamation	1,000,000	10,000	1,000	10
Ulceration	2,000,000	20,000	2,000	20
Radiodermatitis	2,500,000	25,000	2,500	25
Epilation	300,000	3,000	300	3

These dose-effect relationships are good approximations and they can vary from individual to individual. They are also energy dependent.

Epilation occurs 10 to 20 days post exposure.

The initial evidence of damage is an erythema, which seldom appears before 24 hours post exposure and in most cases may appear days later. These skin effects are often referred to as "radiation burns."

In contrast to thermal and chemical burns, pain is not associated with initial erythema of a radiation injury. The texture of the skin will initially be normal to sight and touch. Photographs of suspicious lesions should always be taken.

Hair distribution is usually normal in the first days following exposure. Epilation does not occur before 10 to 20 days after exposure. Little, if any, treatment will be required in the emergency department for local exposures.

The patient must be referred to a radiation medicine specialist for follow up care.

Total Body External Exposure

In Total Body External Exposure, the GI tract and the bone marrow are the organs of interest in the emergency department. Dose-effect relationship for the total body exposures are listed in the following table.

Total Body External Exposure

Condition	mRem	mSv	Rem	Sv
No observable effects	5,000	50	5	0.05
Chromosome damage	15,000	150	15	0.15
White Count Depression	50,000	500	50	0.50
Symptom Threshold	100,000	1,000	100	1.00

Approaching 100% Lethality 600,000 6,000 600 6.00 Below a dose of 100,000 mRem (100 Rem or 1 Sv), patients are almost always asymptomatic. Above this dose, the time of onset and severity of symptoms are related to the total dose.

Except for overwhelming exposures (greater than 500–800 Rem or 5–8 Sv), the initial symptoms of the acute radiation syndrome (headache, malaise, anorexia, nausea and vomiting) usually do not appear until hours post exposure.

With doses greater than 200,000 mRem (200 Rem or 2 Sv), symptoms of bone marrow depression will appear in about two to three weeks.

If the patient is symptomatic or the initial dose is greater than 100 Rem (1 Sv), the patient should be hospitalized and a radiation specialist notified immediately.

Asymptomatic patients with dose estimates less than 100 Rem (1 Sv) can be followed on an outpatient basis. The patient and his family will be exceedingly anxious about the exposure. Early and continuous counseling regarding radiation effects will be required.

Decontamination

The priority in handling the contaminated/injured patient requires that medical treatment for serious conditions always takes precedence over decontamination. Contamination that is not visible to the naked eye dirt, liquid etc. will not have enough radioactivity to cause early or visible radiation injury to the patient or attendant, and late effects are likely to be negligible.

An unhurried approach to the decontamination is also influenced by the fact that radiation intensity decreases with the passage of time.

Contaminated clothing, fluids and other material should be saved and removed to a more distant controlled area.

Following any "quick decontamination" for the unusual high level of contamination, a more orderly management of the patient should begin. After stabilization, a careful survey of the naked body should be performed. The amount of activity and its location are carefully recorded on anatomical burn type charts. Then, orderly decontamination begins.

Decontamination should be performed with the following priorities:

- Wounds
- Orifices
- High-level skin areas
- Low-level skin areas

How: Ordinary surgical soaps and copious amounts of water and/or saline are used to scrub the contaminated area.

The first attempt will usually remove 90% of the contamination. All contaminated liquids are carefully collected in containers and saved for later disposal.

Difficult areas of fixed contamination should be sealed off with gloves, plastic dressings etc. and professional assistance sought. Following decontamination, the patient should be transported to the nearest hospital and a radiation specialist should be notified.

How to Minimize Radiation Exposure

- Time – Reducing the time of exposure reduces the exposure.
- Distance – If you double the distance between you and the radiation source, amount of exposure is reduced to ¼ the previous amount.
- Shielding – Shielding provides protection from radiation by absorbing the energy before it gets to you.
- Get out of the immediate area quickly.
- Remove the outer layer of your clothing.

If possible, place the clothing in a plastic bag or leave it in an out-of-the-way area:

1. Keep people away from contaminated clothing and areas.

2. Keep cuts and abrasions covered when handling contaminated items.

- Decontamination process - Wash all the exposed parts of your body using lots of soap and lukewarm water to remove contamination. Avoid spreading contamination to parts of the body that were not contaminated (e.g., areas under clothing).

- If authorities determine that internal contamination may have occurred, you may be able to take medication to reduce the radioactive material in your body.

What to do in a Radiation Emergency

If you know you are within the area of radiation exposure follow instructions above on "How to Minimize Radiation Exposure."

- If you do not know where the source of radiation is:

1. Listen for radio or television reports for instructions.

2. Take shelter until an evacuation is ordered and do not evacuate unless told to do so.

3. If an evacuation is ordered for your area, local authorities will alert you with radio and television messages.

4. If in a car, turn off ventilation system, close windows and listen to radio for instructions.

5. Instruction will be given regarding where the emergency shelter is located and in which direction you should travel to avoid radioactive plume.

6. If you have children in school, their schools have their own plan for sheltering and will follow authority's orders. Do not try to go to the school and remove your children. The school will not release the children until they have an "all clear."

7. If told to evacuate; act quickly. If you have time, turn off air conditioner, heater, or ventilation system in house/office and close and lock all windows and doors.

8. If asked to shelter in place:
    a. Stay in a centrally located room or basement with an attached bathroom.
    b. Seal doors and windows using duct tape and plastic sheeting, if available. Leave sealed only for a few hours.
    c. Keep radio turned to an emergency response network at all times for updates and instructions.

Managing Nuclear and Radiation Emergencies

Radiation is not a modern creation. Most radiation comes from natural sources – the air, rocks, earth, sun, building materials and even the food we eat. The term radiation is very broad and includes such things as light and radio waves. But it is most often used to mean ionizing radiation, which is radiation that can produce charged particles (ions) in the materials it strikes. Natural sources of ionizing radiation include cosmic rays from the sun and outer space, and radioactive elements that occur naturally in the soil, rocks and building materials, such as concrete.

Nuclear radiation is particles or rays given off by unstable atoms. Radiation is produced inside a nuclear reactor when the uranium atoms split or "fission". This also produces heat, which is used to generate electricity. The three basic types of ionizing radiation produced by radioactive atoms are alpha particles, beta particles, and gamma rays. Alpha particles and beta particles have low penetrating power.

- Alpha particles can be blocked by a piece of paper.
- Beta particles can be blocked by a thick piece of cardboard or by a piece of aluminum foil.
- Gamma rays are electromagnetic energy, similar to visible light and x-rays, but they have a higher penetrating power. Heavy shielding of lead or concrete, such as a nuclear power plant's containment structure, will stop gamma rays.

The unit most commonly used to measure human exposure to radiation is the rem. Because most normal exposures involve only a fraction of a rem, the most commonly used unit is the millirem, one thousandth of a rem.

The amount of natural radiation to which people are exposed depends upon where they live and the concentration of radioactive materials in the ground. The following table gives you an idea of sources of radiation that people are most often exposed to. The effects of human exposure to radiation depend upon how much is received, the length of exposure and the person's general health and age. Shortening the time of exposure, getting farther away from the source, and shielding or blocking the source can reduce the risk of radiation exposure. It is known that whole-body radiation doses of more than 10,000 millirem over a short period of time can cause a slight increase in a person's risk of developing some types of cancer years after exposure. The risk that radiation-induced cancer will develop during the person's lifetime is estimated by the National Academy of Sciences to be about 1/20 of one percent for every 1,000 millirem of short-term exposure greater than 10,000 millirem. In other words, if you were to receive a short-term exposure of 11,000 millirem (11 rem), your estimated risk of developing some type of cancer would increase by 0.05 percent.

Both the Federal government and the State of Wisconsin have established radiation dose limits for the public from a nuclear power plant at 100 millirem/year. For doses expected to be greater than 1,000 millirem, protective actions such as evacuations or sheltering would be required.

The purpose of these actions would be to keep people away from the radioactive materials that might be released during a severe accident.

Radiation Source	Average Annual Radiation in Millirem/Year
Natural Radiation:	
Cosmic Rays	45
Water and Food	35
Soil	125
Man-Made Living in a House Made of:	
Brick	50-100
Concrete	70-100
Wood	30-50
Medical Chest X-Ray	20-50
Round Trip Cross-Country Air Flight	4 -6
Television Viewing	0.05

Explosions and Blast Injuries

Key Concepts

- Bombs and explosions can cause unique patterns of injury seldom seen outside combat.
- The predominant post explosion injuries among survivors involve standard penetrating and blunt trauma. Blast lung is the most common fatal injury among initial survivors.
- Explosions in confined spaces (mines, buildings, or large vehicles) and/or structural collapse are associated with greater morbidity and mortality.
- Half of all initial casualties will seek medical care over a one-hour period. This can be useful to predict demand for care and resource needs.
- Expect an "upside-down" triage - the most severely injured arrive after the less injured, who bypass EMS triage and go directly to the closest hospitals.

Background

Explosions can produce unique patterns of injury seldom seen outside combat. When they do occur, they have the potential to inflict multi-system life-threatening injuries on many persons simultaneously. The injury patterns following such events are a product of the composition and amount of the materials involved, the surrounding environment, delivery method (if a bomb), the distance between the victim and the blast, and any intervening protective barriers or environmental hazards. Because explosions are relatively infrequent, blast-related injuries can present unique triage, diagnostic, and management challenges to providers of emergency care.

Few U.S. health professionals have experience with explosive-related injuries. Vietnam era physicians are retiring, other armed conflicts have been short-lived, and until this past decade, the U.S. was largely spared of the scourge of mega-terrorist attacks. This primer introduces information relevant to the care of casualties from explosives and blast injuries.

Classification of Explosives
Explosives are categorized as high-order explosives (HE) or low-order explosives (LE). HE produce a defining supersonic over-pressurization shock wave. Examples of HE include TNT, C-4, Semtex, nitroglycerin, dynamite, and ammonium nitrate fuel oil (ANFO). LE create a subsonic explosion and lack HE's over-pressurization wave. Examples of LE include pipe bombs, gunpowder, and most pure petroleum-based bombs such as Molotov cocktails or aircraft improvised as guided missiles. HE and LE cause different injury patterns.

Explosive and incendiary (fire) bombs are further characterized based on their source. "Manufactured" implies standard military-issued, mass produced, and quality-tested weapons. "Improvised" describes weapons produced in small quantities, or use of a device outside its intended purpose, such as converting a commercial aircraft into a guided missile. Manufactured (military) explosive weapons are exclusively HE-based. Terrorists will use whatever is available illegally obtained manufactured weapons or improvised explosive devices (also known as "IEDs") that may be composed of HE, LE, or both. Manufactured and improvised bombs cause markedly different injuries.

Blast Injuries
The four basic mechanisms of blast injury are termed as primary, secondary, tertiary, and quaternary (Table 1)."Blast Wave" (primary) refers to the intense over-pressurization impulse created by a detonated HE. Blast injuries are characterized by anatomical and physiological changes from the direct or reflective over-pressurization force impacting the body's surface. The HE "blast wave" (over-pressure component) should be distinguished from "blast wind" (forced super-heated air flow). The latter may be encountered with both HE and LE.

Table 1: Mechanisms of Blast Injury

Category	Characteristics	Body Part Affected	Types of Injuries
Primary	Unique to HE, results from the impact of the over-pressurization wave with body surfaces.	Gas filled structures are most susceptible - lungs, GI tract, and middle ear.	Blast lung (pulmonary barotrauma) TM rupture and middle ear damage Abdominal hemorrhage and perforation Globe (eye) rupture Concussion (TBI without physical signs of head injury)
Secondary	Results from flying debris and bomb fragments.	Any body part may be affected.	Penetrating ballistic(fragmentation) or blunt injuries Eye penetration (can be occult)
Tertiary	Results from individuals being thrown by the blast wind.	Any body part may be affected.	Fracture and traumatic Amputation. Closed and open brain injury
Quaternary	All explosion-related injuries, illnesses, or diseases not due to primary, secondary, or tertiary mechanisms. Includes exacerbation or complications of existing conditions.	Any body part may be affected.	Burns (flash, partial, and full thickness) Crush injuries Closed and open brain injury Asthma, COPD, or other breathing problems from dust, smoke, or toxic fumes Angina, Hyperglycemia, hypertension

LE are classified differently because they lack the self-defining HE over-pressurization wave. LE's mechanisms of injuries are characterized as due from ballistics (fragmentation), blast wind (not blast wave), and thermal.

There is some overlap between LE descriptive mechanisms and HE's Secondary, Tertiary, and Quaternary mechanisms.

Table 2: Overview of Explosive-Related Injuries

System	Injury or Condition
Auditory	TM rupture, ossicular disruption, cochlear damage, foreign body
Eye, Orbit, Face	Perforated globe, foreign body, air embolism, fractures
Respiratory	Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, A-V fistulas (source of air embolism), airway epithelial damage, aspiration pneumonitis, sepsis
Digestive	Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism
Circulatory	Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism-induced injury
CNS Injury	Concussion, closed and open brain injury, stroke, spinal cord injury, air embolism-induced injury
Renal Injury	Renal contusion, laceration, acute renal failure due to rhabdomyolysis hypotension, and hypovolemia
Extremity Injury	Traumatic amputation, fractures, crush injuries, compartment syndrome, burns, cuts, lacerations, acute arterial occlusion, air embolism-induced injury

Note: Up to 10% of all blast survivors have significant eye injuries. These injuries involve perforations from high-velocity projectiles that can occur with minimal initial discomfort, and present for care days, weeks, or months after the event. Symptoms include eye pain or irritation, foreign body sensation, altered vision, periorbital swelling or contusions. Findings can include decreased visual acuity, hyphema, globe perforation, subconjunctival hemorrhage, foreign body, or lid lacerations. Liberal referral for ophthalmologic screening is encouraged.

Selected Blast Injuries

Lung Injury

"Blast lung" is a direct consequence of the HE over-pressurization wave. It is the most common fatal primary blast injury among initial survivors. Signs of blast lung are usually present at the time of initial evaluation, but they have been reported as late as 48 hours after the explosion. Blast lung is characterized by the clinical triad of apnea, bradycardia, and hypotension. Pulmonary injuries vary from scattered petechae to confluent hemorrhages.

Blast lung should be suspected for anyone with dyspnea, cough, hemoptysis, or chest pain following blast exposure. Blast lung produces a characteristic "butterfly" pattern on chest X-ray.

A chest X-ray is recommended for all exposed persons and a prophylactic chest tube (thoracostomy) is recommended before general anesthesia or air transport is indicated if blast lung is suspected.

Ear Injury
Primary blast injuries of the auditory system cause significant morbidity, but are easily overlooked. Injury is dependent on the orientation of the ear to the blast. TM perforation is the most common injury to the middle ear. Signs of ear injury are usually present at time of initial evaluation and should be suspected for anyone presenting with hearing loss, tinnitus, otalgia, vertigo, bleeding from the external canal, TM rupture, or mucopurulent otorhea. All patients exposed to blast should have an otologic assessment and audiometry.

Abdominal Injury
Gas-containing sections of the GI tract are most vulnerable to primary blast effect. This can cause immediate bowel perforation, hemorrhage (ranging from small petechiae to large hematomas), mesenteric shear injuries, solid organ lacerations, and testicular rupture. Blast abdominal injury should be suspected in anyone exposed to an explosion with abdominal pain, nausea, vomiting, hematemesis, rectal pain, tenesmus, testicular pain, unexplained hypovolemia, or any findings suggestive of an acute abdomen. Clinical findings may be absent until the onset of complications.

Brain Injury
Primary blast waves can cause concussions or mild traumatic brain injury (MTBI) without a direct blow to the head. Consider the proximity of the victim to the blast particularly when given complaints of headache, fatigue, poor concentration, lethargy, depression, anxiety, insomnia, or other constitutional symptoms. The symptoms of concussion and post traumatic stress disorder can be similar.

Emergency Management Options

- Expect an “upside-down” triage - the most severely injured arrive after the less injured, who by-pass EMS triage and go directly to the closest hospitals.

- Double the first hour’s casualties for a rough prediction of total “first wave” of casualties.

- Obtain and record details about the nature of the explosion, potential toxic exposures and environmental hazards, and casualty location from police, fire, EMS, ICS Commander, regional EMA, health department, and reliable news sources.

- If structural collapse occurs, expect increased severity and delayed arrival of casualties.

Hazardous Materials Management Levels of Personal Protective Equipment

1. Level A – Best respiratory and skin protection

a. Positive pressure SCBA and

b. Fully encapsulated, vapor tight chemical protective suit

2. Level B – High level of respiratory protection but less for skin

a. Positive pressure SCBA and

b. Hooded chemical resistive clothing

3. Level C – Air purifying respirators and modest skin protection

a. Full or half-mask APR and

b. Hooded chemical resistive clothing

4. Level D – Ordinary work uniform, minimal protection

a. No respiratory protection

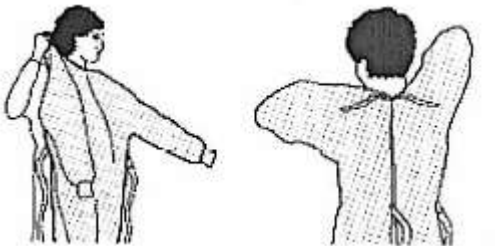
b. Minimal splash and vapor protection

c. May actually absorb vapors, gases and liquids

Donning Procedure for PPE Sequence for Donning Personal Protective Equipment (PPE)

1. Gown

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and wrist



2. MASK FOR RESPIRATOR

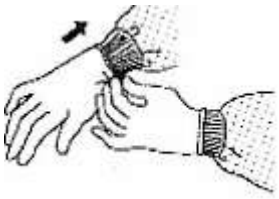
- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bride
- Fit snug to face and below chin
- Fit-check respirator

3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit

4. GLOVES

- Extend to cover wrist of isolation gown



Use Safe Work Practices to Protect Yourself And Limit The Spread Of Contamination

∗ Keep hands away from face

∗ Limit surfaces touched

∗ Change gloves when torn or heavily contaminated

∗ Perform hand hygiene

Donning Procedure for PPE Sequence for Removing Personal Protective Equipment (PPE)

1. GLOVES

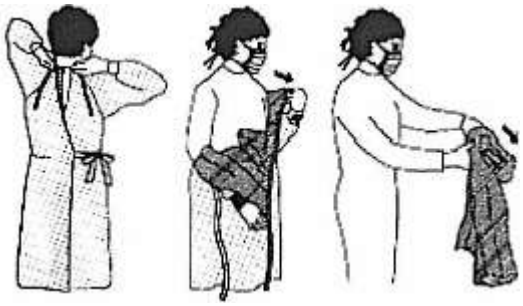
- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off
- Hold removed gloved in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist
- Peel glove off over first glove
- Discard gloves in waste container

2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield is contaminated!
- To remove, handle by head band or ear pieces
- Place in designated receptacle for reprocessing or in waste container

3. GOWN

- Gown front and sleeves are contaminated!
- Unfasten ties
- Pull away from neck and shoulders, touching inside of gown only
- Turn gown inside out



- Fold or roll into a bundle and discard

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated—DO NOT TOUCH!
- Grasp bottom, then top ties or elastics and remove
- Discard in waste container

PERSONAL PRECAUTIONS

STANDARD PRECAUTIONS
▪ Hand-Washing
❖ Wash hands immediately after gloves are removed, between patient contacts, after touching blood, body fluids, secretions, excretions, and contaminated items and when otherwise indicated to avoid transfer of microorganisms to other patients or environments
❖ Use an antimicrobial agent, a waterless antiseptic agent or water and soap for 30 seconds
▪ Gloves
❖ Wear clean, non-sterile gloves when touching blood, body fluids, secretions, excretions, and contaminated items
❖ Put on clean gloves before touching mucous membranes, non-intact skin or blood, body fluids, secretions, excretions, and contaminated items
❖ Change gloves between tasks and procedures on the same patient, after changing patients and coming in contact with material that may contain a high concentration of Microorganisms.
❖ Remove gloves promptly after use, before touching non-contaminated items to avoid transfer of microorganisms
▪ Mask, Eye Protection, Face Shield
❖ Wear a mask and eye protection or a face shield to protect mucus membranes of the eyes, nose, and mouth during procedures and patient-care activities with the potential to generate splashes or sprays of blood, body fluids, secretions, and excretions
▪ Gown
❖ Wear a clean, non-sterile gown to protect skin and to prevent soiling of clothing during procedures and patient-care activities that could generate splashes or sprays of blood, body fluids, secretions, or excretions. Remove a soiled gown promptly, and wash hands to avoid cross contamination
▪ Patient-Care Equipment
❖ Handle contaminated patient-care in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately. Discard single-use items properly
▪ Occupational Health and Bloodborne Pathogens
❖ Take care to prevent injuries when using all sharps and instruments or devices. Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers
❖ Use mouthpieces, resuscitation bags, or other ventilation devices as an alternative to mouth-to-mouth resuscitation if available
AIRBORNE PRECAUTIONS
▪ Respiratory Protection
❖ Wear respiratory protection (N95 respirator) when working with a patient known or suspected of infectious pulmonary tuberculosis or other airborne communicable diseases.
❖ Susceptible health care providers should not provide patient care to patients known or suspected to have measles (rubeola) or varicella (chickenpox) if other immune caregivers are available.
❖ Patients that need to be transported with respiratory concerns should be masked if possible/available
CONTACT PRECAUTIONS
▪ In addition to wearing gloves as outlined under Standard Precautions, during the course of providing patient care, change gloves after contact with an infective material or any body fluids. Remove gloves and wash hands immediately with an antimicrobial agent or a waterless antiseptic agent. After removal and hand washing, ensure that hands do not touch anything contaminated to avoid cross contamination
▪ Wear a clean gown if your personal clothing will have substantial contact with the patient, environmental surfaces, or if the patient is incontinent or has diarrhea, an ileostomy, a colonostomy, or wound drainage not contained by a dressing. Remove the gown before leaving the patient's environment. After gown removal, ensure that clothing does not contact potentially contamination to avoid cross contamination
▪ If the patient requires transport, ensure precautions are maintained to minimize the risk of cross contamination
▪ When possible, dedicate the use of non-critical patient-care equipment to a single patient to prevent cross contamination. If common equipment or items is unavoidable, then adequately clean and disinfect between patient use
DROPLET PRECAUTIONS
▪ Maintain spatial separation of at least 3 feet between the infected patient and other patients and visitors.
▪ Wear a mask when working within 3 feet of the patient
▪ If transport is necessary, minimize patient dispersal of droplets by ensuring patient is masked, if possible

ISOLATION PRECAUTIONS FOR FACILITIES OR SHELTERS

STANDARD PRECAUTIONS	Wash hands after patient contact
Modified Isolation (17 CCR 2518)	Wear gloves when touching blood, body fluids, secretions, excretions and contaminated items
	Wear a mask and eye protection, or a face shield during procedures likely to generate splashes or sprays of blood, body fluids, secretions or excretions
	Handle used patient-care equipment and linen in a manner that prevents the transfer of microorganisms to people or equipment
	STANDARD PRECAUTIONS ARE EMPLOYED IN THE CARE OF ALL PATIENTS
AIRBORNE PRECAUTIONS	**STANDARD PRECAUTIONS PLUS:**
Strict Isolation (17 CCR 2516)	Place the patient in a private room that has monitored negative air pressure, a minimum of six air changes/hour, and appropriate filtration of air before it is discharged from the room
	Wear respiratory protection when entering the room
	Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.
DROPLET PRECAUTIONS	**STANDARD PRECAUTIONS PLUS:**
Strict Isolation (17 CCR 2516)	Place the patient in a private room or cohort them with someone with the same infection. If not feasible, maintain at least 3 feet between patients
	Wear a mask when working within 3 feet of the patient
	Limit movement and transport of the patient. Place a mask on the patient if they need to be moved.
	Conventional Diseases requiring Droplet Precautions: Invasive Haemophilus influenzae and meningococcal disease, drug-resistant pneumococcal disease, diphtheria, pertussis, mycoplasma, GABHS, influenza, mumps, rubella, parvovirus
	Biothreat Diseases requiring Droplet Precautions: Pneumonic Plague
CONTACT PRECAUTIONS	**STANDARD PRECAUTIONS PLUS**:
Strict Isolation (17 CCR 2516)	Place the patient in a private room or cohort them with someone with the same infection, if possible
	Wear gloves when entering the room. Change gloves after contact with infective material
	Wear a gown when entering the room if contact with patient is anticipated or if the patient has diarrhea, a colostomy or wound drainage not covered by a dressing
	Limit the movement or transport of the patient of the patient from the room
	Conventional Diseases requiring Contact precautions: MRSA, VRE. Clostridum difficile, RSV,MRSA, VRE. Clostridum difficile, RSV, parainfluenza, enteroviruses, enteric infections in the incontinent host, skin infections (SSSS, HSV, impetigo, lice, scabies) hemorrhagic conjunctivitis Biothreat Diseases requiring Contact Precautions: Viral Hemorrhagic Fevers

Appendices

Appendix A: NIMS (National Incident Management System)

NIMS is a series of organizational systems for use in the response to any disaster. NIMS provides government organizations with clear and consistent strategies for responding to emergencies and disasters, and a table of organization that is consistent among all Wisconsin governments. NIMS can be used in any emergency, including earthquakes, fires, mudslides, toxic accidents, civil unrest and others.

All governments at the federal, state and local level are expected to use NIMS in responding to disasters. This includes state agencies, counties, cities, public school districts, and all other special districts.

THE NIMS SYSTEM

Five Operational Concepts

- *Incident Command System (ICS):* An event management system that is used at all organizational levels. It includes roles that have standardized responsibilities and chain of communication.

- *Mutual Aid:* A statewide system for obtaining additional emergency resources from non-affected jurisdictions.

- *Multi/Inter-Agency Coordination:* Affected agencies work together to coordinate allocations of resources and emergency response activities.

- *Operational Area Concept:*
  - Central unit of organization;
  - County and its political subdivisions (cities and special districts);
  - Coordinates damage information, resource requests and emergency responses.

- Standardized emergency communication – various state wide systems

Five Functions of NIMS

Also known as the Incident Command System ICS. This is the basic operating structure at each level. Depending on the size of a response an individual may carry out more than one function or be a part of a large team carrying out a single function. Any function can be carried out by a member of any discipline.

- Management: Provides overall direction and coordination and sets priorities for an emergency. Directly supervises liaison, public information, and other special functions.

- Operations: Performs the activities of the emergency response based on priorities and direction of management. Some examples:
  - Work in an Alternate Care Site
  - Work in a First Aid Station
  - Provide a Mass prophylaxis clinic

- Planning/intelligence: Gathers, assesses and disseminates information; maintains documentation of all activities during an event. Some examples:
    - Setting patient evacuation
    - Tracking patients through Mass Immunization Clinic
    - Monitor weather changes

- Logistics: Obtains the resources to support the operations. Some examples:
    - Sets up and monitors electrical and water supply systems
    - Monitors and logs durable equipment usage
    - Obtains other needed equipment

- Finance/Administration: Tracks costs, arranges for contracts with vendors, and approves expenditures related to the operation. Provides other administrative support as required.
    - Keeps workers' comp logs,
    - Personnel records,
    - Patient documentation

EOC/DOC

Emergency Operations Center (EOC) – Centralized site housing representatives from all responding agencies.

The EOC

- Pre-identified location where representatives from all responding entities, for example
    - Law Enforcement
    - Fire Department
    - Public Health
    - Mental Health
    - Red Cross

- Manage a response to an event in a coordinated manner

- Represents the operational area affected by the event

- Public Health is usually represented by the Health Officer, Public Health Director or the Nursing Director

- In instances where an event is widespread there may be EOC's at the regional and State levels

When working in a disaster response identify:

- Organizational level you are assigned to work on

- Functional role

- Communication chain for situation and status reports through the operational levels
- Communication chain for resource requests through operational levels

Do not bypass a level in communication.

Appendix B: Mass Fatality Management

An event involving mass casualties as a result of a disaster will have the potential for great losses of life. The remains of humans that do not survive will require special handling. This increase in fatalities may overwhelm the usual routine capabilities and resources of the community. The fatalities will not occur in one defined scene; fatalities may occur in hospitals, medical facilities, physician's offices and private residences. While the local Coroner or Medical Examiner is responsible for the proper collection, examination, identification, storage and disposition of any deceased victims, there are public health issues which may require collaboration and intervention by public health staff. Issues to be considered by nursing staff include:

• **Staffing and Resources** – A team for evaluating and processing human remains will be formed with Medical Examiners, Hazmat Technicians, Law Enforcement and Public Health staff.

• **Body Retrieval** – Specialized assistance may be required to retrieve any human remains located in a "HOT" zone. This type of assistance shall be obtained from trained HAZMAT personnel, or Disaster Mortuary Operational Response Teams (DMORT). DMORT is a national program that includes volunteers who support death investigation and mortuary services in federal emergency response situations involving natural disasters and mass fatalities associated with transportation accidents or terrorism. Team members are specialists from multiple forensic disciplines, funeral directors, law enforcement agents, and administrative support personnel. DMORT members are activated through DHS after mass fatalities or events involving multiple displaced human remains (e.g., a cemetery washout after a flood).

• **Decontamination** – The majority of potential biologic terrorism agents (B. anthracis, Y. pestis, or botulinum toxin) are unlikely to be transmitted to personnel engaged in the non-autopsy handling of a contaminated cadaver. However, such agents as the hemorrhagic fever viruses and smallpox virus can be transmitted in this manner. PPE equipment that is recommended for the specific biologic agent should be worn while handling all cadavers. When bodies are bagged at the scene of death, surface decontamination of the corpse-containing body bags is required before transport. Bodies can be transported and stored (refrigerated) in impermeable bags (double-bagging is preferable), after wiping visible soiling on outer bag surfaces with 0.5% hypochlorite solution. Human remains must be thoroughly decontaminated prior to examination, evidence collection and in the case of an autopsy. Trained personnel knowledgeable in hazardous materials decontamination and crime scene/evidence preservation shall carry out decontamination of the deceased. Decontamination solvents are based on the specific agent. Personnel must wear PPE until remains are verified clean by chemical agent monitoring.

• **Remains Storage** – The number of fatalities may overwhelm the system and necessitate the establishment of temporary morgue facilities. Refrigerated storage units may be used for storage or transport of remains. Personal effects should be removed and tagged, separated into durable and non-durable items, and stored separately from remains.

• **Patient Identification** – Every attempt shall be made to identify the remains of the deceased. Any available patient information should be documented, using a standard DMORT Personal Information Questionnaire or alternate means of documentation as identified by the local Coroner.

• **Final Disposition of Remains** – Once any criminal investigation is completed and the bodies of the deceased are released, the disposition of remains process would begin. Burial in the ground is most often used to dispose of corpses; however, cremation of corpses may be considered if a significant health threat is determined to exist. Depending on the biological agent, the human remains may not be able to be released to families; government sponsored disposition may occur.

Appendix C: The Basic Laboratory

The basics of a diagnosis can generally be reached by a careful history and physical examination. Modern medicine relies heavily on laboratory investigations. In a large disaster these may not be available. However there are some simple laboratory tests which can be performed with very little equipment or chemicals. The problem is that even basic tests require some equipment ranging from simple test strips to a microscope and a few chemicals.

Urine Testing: Urine is easily tested with a multi-function dipstix. These can test for the presence of protein, glucose, ketones, nitrates, red blood cells, and white blood cells. The test strip is dipped in a specimen of clean catch urine (i.e. urination begins in the toilet, stop, then start again into the specimen container, stop, and continue into the toilet) and panels containing the test reagents change color depending on the presence and concentrations of the substance being tested for. The color changes are compared to a table supplied with the strips. The strips can be used to diagnose urinary infections, toxemia in pregnancy, dehydration, diabetes (outside pregnancy), and renal stones/colic.

These urinalysis reagent strips test for the following:

- Leukocytes
- Nitrite
- Urobilinogen
- Bilirubin
- Ketones
- Protein
- PH
- Specific gravity
- Glucose
- Blood

Urinalysis

Of the various bodily fluids urine is the most easily obtained. It is possible to perform a number of tests on urine with little or no equipment. Visual and olfactory examination of a urine sample alone can provide considerable information. Urine which is pink, red, or red-orange may contain blood although it is important to remember that these colors may also be seen in those who have eaten certain foods such as beets, blackberries, or rhubarb. Urine which is green or blue-green, or which takes on these hues on standing may indicate diseases of the liver or gall bladder.

Bright yellow or yellow-orange urine is indicative of kidney dysfunction (if there is no reason for the urine to be concentrated and if the color is maintained for several days). Cloudy urine may result from abnormally high levels of phosphates or carbonates in the urine, and may be a precursor of kidney stones. Cloudy urine may also indicate the presence of an infection particularly if the fresh urine has an odor of ammonia or other disagreeable odor (note that urine will develop an ammonia odor on standing).

It is possible to approximately localize an infection that is producing cloudy urine by using the three-glass test. This test requires three clean containers (glasses) of which at least one (the second used) will need a capacity of at least 500 ml. In this test, the first 5 ml is voided into the first container, the second container is used until the patient is almost done, and then the third container is used to collect the last 5 ml. If the urine in the first container is the cloudiest, with decreasing cloudiness in the remaining containers, a urethral infection is the most likely cause. If the urine in the first container is less cloudy than either of the following two, a kidney, bladder, or prostate infection is indicated as the cause while if the urine in the third container is the cloudiest the prostate is the likely site of the infection.

The odor of maple syrup associated with fresh urine is, of course, the classic sign of maple syrup urine disease. The urine may also have characteristic odors which are associated with other genetic disorders: the `mousy' odor associated with phenylketonuria for instance; the presence of glucose in urine has long been recognized as an indication of diabetes and its detection has been assigned a high degree of importance by the general public. While its presence was at one time detected by taste a more aesthetically acceptable method (which is also less likely to transmit infection) is to heat the urine and observe the odor. If the scent of burning sugar or caramel is detected there is an excessive amount of sugar present.

Proteins, or carbonates and phosphates in urine may be detected by filling a test tube three-fourths full of urine and boiling the upper portion. Any cloudiness produced by this may arise from either the presence of carbonates and phosphates (which may be normal) or from the presence of proteins. These two causes may be differentiated by adding a small amount of acetic acid (3-5 drops of 10% acetic acid) to the tube: if the cloudiness vanishes carbonates and phosphates were the cause; if the cloudiness persists or becomes apparent only after the acid is added, proteins are present. The iodine ring test is simple tests which can detect the presence of bile in the urine before color changes or jaundice makes its presence obvious. In this test the appearance of a green ring after layering a 10% alcoholic iodine solution over the urine in a test tube indicates the presence of bile.

Blood Counts

There is no easy way to do blood counts without some basic equipment. You need a microscope and a graded slide. A graded slide is a microscope slide which has very small squares etched onto its surface. Using a standardized technique a smear of blood is placed on the slide. Now using the microscope the number of different types of blood cells in a square on the slide is counted, this is repeated several times and then averaged. This technique will give you:

- White Cell count
- White Cell differential

- Red Cell count
- Platelet count

This graded slide is called a hemacytometer. The hemacytometer frequently comes as a kit with two graduated pipettes, the hemacytometer itself, the cover slip. The basic procedure is to dilute the sample to a given ratio and place that sample on the tiny grid etched into the glass of the hemacytometer. A cover slip is a precise set distance from the bottom of the slide creating a known volume for each of the squares. The sample and the hemacytometer are then viewed through the microscope. The idea is to count how many cells appear in the squares. Several squares are counted and taken into account to average out the number.

For example: You dilute the sample of blood to a 1:20 with a 1% acetic acid solution (diluted white vinegar can possibly be used in place of the glacial acetic acid). You then place it under the microscope and count eight 1 square mm area, and get a total number of 300 white cells. Then use the formula:

$$\frac{\text{Cells counted X dilution X 10}}{\text{Number of 1 sq. mm areas counted}}$$

-or-

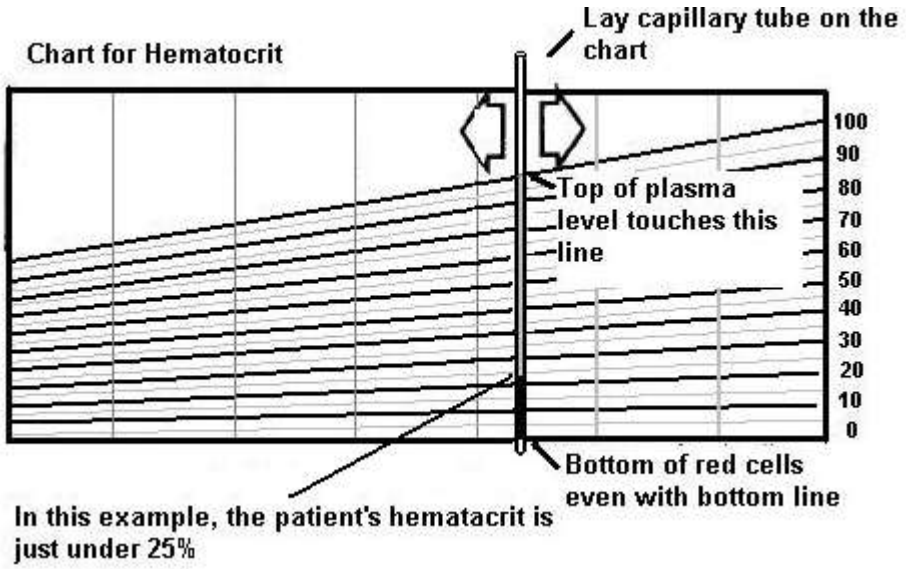
$$\frac{300 \text{ X } 20 \text{ X } 10}{8}$$

= 7,500 white cells per cc of blood.

Red blood cell counts can also be done in this manner, with slightly different preparation and procedure although a hematocrit (percentage of red blood cells whole blood) is more commonly used for diagnosis.

The hematocrit test consists essentially of drawing a blood sample, adding a small amount of anticoagulant to prevent clotting (such as sodium citrate or heparin), and placing a sample in a very tiny glass tube called a capillary tube. The capillary tube end is sealed with a clay-like substance, centrifuged for 5 minutes at 2000 rpm. The packed red blood cell volume is determined by comparison with a standard scale on a micro hematocrit reader.

NOTE: The picture below is for illustration purposes only. DO NOT attempt to use it as the hematocrit scale!



Blood Grouping:
There are four basic blood types: A, B, AB, and O. There is also an additional subgroup of each type of blood, Rh+ or Rh-. Some of these blood groups are compatible with one another some are not.

Can Receive:

Patient Blood Type	O-	O+	B-	B+	A-	A+	AB-	AB+
AB+								
AB-								
A+								
A-								
B+								
B-								
O+								
O-								

This chart shows the patient's blood type on the vertical axis on the left, and the donor's blood type across the top. Note that O blood type can be given to any patient, and that a patient with AB+ blood type can receive blood from anyone. There are other further subdivisions of blood which can make a whole-blood transfusion not as simple as the chart above, but it's a starting point. The simplest thing to do is have your group or expedition blood typed prior to your expedition or a disaster.

However, provided you have several basic chemicals a cross match is a simple test. If you are unable or unwilling to have this done (usually the Red Cross will give you a donor card with that information on it when you donate blood) there is another method that is nearly as simple. For economic reasons usually ABO and Rh has been done using liquid anti-A, anti-B, and anti-D (anti-D tests Rh +/-) sera on slides mixed with drops of blood. Then the drops were observed to see which agglutinated or "clumped together". There is a method to dry the anti-A, anti-B, and anti-D sera and put the whole test on a pre-made card commonly called an "Eldon Card." The cards have a shelf life of roughly three years when stored in the refrigerator. ABO typing with sera is well-described in any basic laboratory medicine textbook.

Cross Matching

Just having compatible ABO/Rh is not enough to assure a safe blood transfusion. To be certain that a transfusion will be safe a direct compatibility or "cross match" test is performed. There are several ways to perform a cross match. A saline cross match and an albumin cross match are two of them. The albumen cross match consists of a drop of 30% bovine albumin added to a saline cross match. It requires bovine –cow albumin which may not be available in austere conditions. Under ideal conditions both types of cross match are performed, and more.

Saline Cross Match Method:

1. Take a few drops of the donor blood to be cross matched and place it into a tube full of saline (0.9%).

2. Spin with a centrifuge.

3. You will be left with a small deposit of washed red cells in the bottom of the tube. Pipette (draw) off the saline to leave a deposit of nearly dry washed red cells.

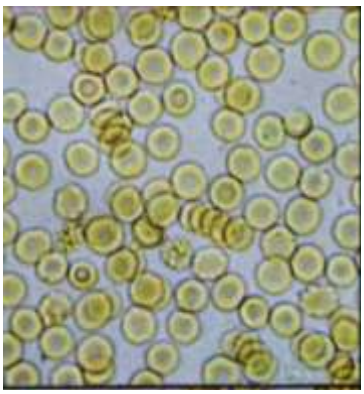
4. Add fresh saline solution to the cells in the bottom of the tube. You will add saline until there is approximately twenty times as much saline as red cells. Don't make the suspension too weak.

5. Separate the cells from the serum of the patient's blood by placing a sample in a tube and spinning it with a centrifuge. The cells will once again be in the bottom of the tube with the serum on top.

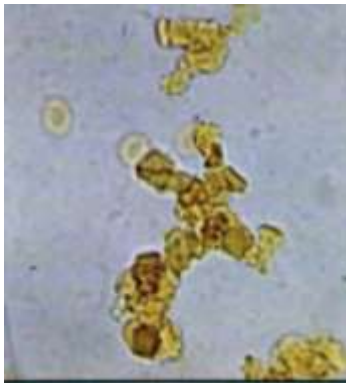
6. Place two drops of the suspension in a fresh, clean, sterile tube and add two drops of the patient's serum.

7. Mix and keep at body temperature for two hours.

8. Observe sample with a microscope. If the cells are clumping and sticking together this is agglutination, and the donor's blood should not be given. Sometimes cells will be stacked into neat rolls like stacks of coins. This is different from agglutination. This is called "rouleaux" and it is safe to give the donor's blood. Usually the rouleaux is easy to differentiate from agglutination but sometimes it is not. If not certain, do not give the donor's blood to the patient.



Compatible



Compatible Rouleaux

Incompatible: Agglutination

Gram Staining

This is a technique for approximate identification of bacteria in urine, pus, sputum, cerebral spinal fluid (CSF), and from bacterial cultures. Although not highly accurate in species identification combined with knowledge of the clinical situation it enables a good guess to be made for the appropriate antibiotic. It requires a microscope and also several chemical solutions.

The Gram stain is the most widely used staining procedure in bacteriology. It is called a differential stain since it differentiates between gram-positive and gram-negative bacteria. Bacteria that stain purple with the Gram staining procedure are called gram positive; those that stain pink are said to be gram-negative. Gram-positive and gram negative bacteria stain differently because of differences in the structure of their cell walls.

The gram staining procedure involves four basic steps:

1. The bacteria are first stained with the basic dye crystal violet. Both gram-positive and gram-negative bacteria become directly stained and appear purple after this step.

2. The bacteria are then treated with an iodine solution. This allows the stain to be retained better. Both gram-positive and gram-negative bacteria remain purple after this step.

3. Decoloriser is then added. This is the differential step. Gram-positive bacteria retain the crystal violet-iodine complex while gram-negative are decolorized.

4. Finally, the counterstain safranine is applied. Since the gram-positive bacteria are already stained purple they are not affected by the counterstain. Gram-negative bacteria that are now colorless become directly stained by the safranine. Thus, gram positive appear purple and gram-negative appear pink.

It is important to note that gram-positivity (the ability to retain the purple crystal violet-iodine complex) is not an all-or-nothing phenomenon but a matter of degree.

There are several factors that could result in a gram-positive organism staining gramnegatively:

1. The method and techniques used. Overheating during heat fixation, over decolorisation with alcohol, and even too much washing with water between steps may result in gram-positive bacteria losing the crystal violet-iodine complex.

2. The age of the culture. Cultures more than 24 hours old may lose their ability to retain the crystal violet-iodine complex.

3. The organism itself. Some gram-positive bacteria are more able to retain the crystal violet-iodine complex than others.

Therefore, one must use very precise techniques in gram staining and interpret the results with discretion.

Procedure

1. Heat-fix a smear of a mixture of the bacterium as follows:
    a. Using the dropper bottle of distilled water place a small drop of water on a clean slide by touching the dropper to the slide.
    b. Ideally, should this sample be from a wound it would be cultured on an agar plate, and then a sample colony of cells would be transferred to the slide with a sterilized wire loop. Failing that, take a small sample from the exudates of the wound directly with the sterilized wire loop.
    c. Using the loop spread the mixture over the entire slide to form a thin film.
    d. Allow this thin suspension to completely air dry.
    e. Pass the slide (film-side up) through the flame of the Bunsen burner 3 or 4 times to heat-fix the sample. Never allow any portion of the slide to become hot to the touch.

2. Flood the slide with crystal violet (solution of 0.3% crystal violet in 0.8% ammonium oxalate) and let stand for one minute and then gently wash off with water. Shake off the excess water but do not blot dry between steps.

3. Stain with iodine solution (0.33% iodine + 0.66% potassium iodide in water) for one minute then gently wash with water.

4. Decolorize by adding gram decoloriser (Ethanol:acetone solution 1:1) drop by drop until the purple stops flowing then wash immediately with water.

5. Stain with safranine (0.25% safranine, aqueous solution) for one minute then wash with water.

6. Blot or air dry, and observe using oil immersion lens on your microscope at 1000x magnification.

You may call the cells that you see either gram-positive or gram-negative.

Further classify bacteria by their shape and pattern. Cocci (singular: Coccus) are generally spherical though with some variation from this theme (i.e., elongation or flattening on one side).

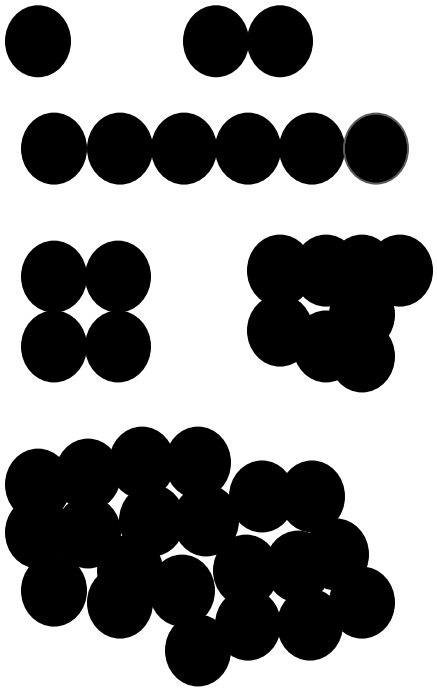
1. Diplococci: Cocci that remain in pairs after they divide

2. Streptococci: Cocci that fail to separate after they divide but instead remain in chains of cells.

3. Tetrad: Cocci that fail to separate after they divide but instead remain in groups of four forming squares.

4. Sarcinae: Cocci that fail to separate after they divide but instead remain in groups of eight forming cubes.

5. Staphylococci: Cocci that fail to separate after they divide but instead remain in amorphous sheets or clumps.



Cocci Diplococci

Streptococci

Tetrad Sarcinae

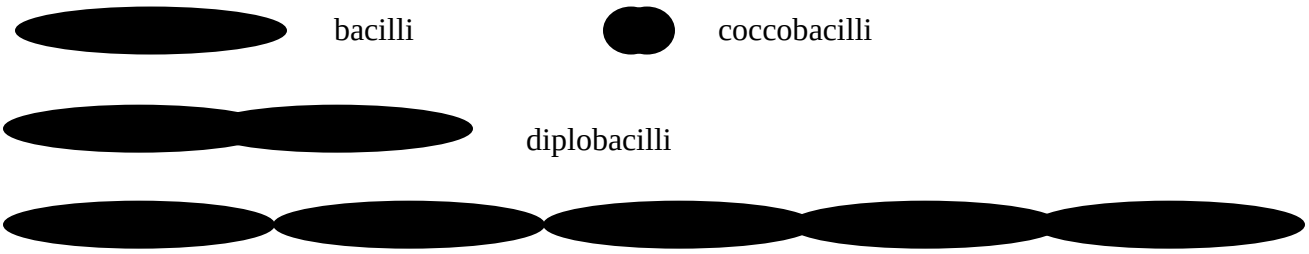
Staphylococci

Bacilli (singular: Bacillus) are rods or variations on rod-shaped bacteria: tapered rod, staff, cigar, oval, or curve shaped. Basically, bacilli are longer than they are wide and lack extreme curvature.

1. Diplobacilli: Paired rods that remain in pairs after they divide.

2. Streptobacilli: Rods that fail to separate after they divide but instead remain in chains of cells.

3. Coccobacilli: A short rod that nearly looks like cocci. Additional bacterial shapes include:



Additional bacterial shapes include:

1. Budding
2. Commas
3. Corkscrews
4. Helical
5. Mycelium
6. Spirillum (rigid, wavy spirals)
7. Spirochetes (flexible spirals)
8. Squares
9. Stars
10. Etc.

Adding the shape and arrangement of the bacteria to the gram-negative or positive status can help you to select the proper antibiotic. Many further tests must be done to isolate the actual specific bacterial organism. Knowing the gram status and general morphology (shape and pattern) can aid in eliminating possible antibiotic treatments. Most often clinical experience and history is the best indicator of treatment regimen.

Growing Bacteria
Most bacteria can be grown on simple agar plates. There are some which are difficult to grow (e.g. the bacteria causing TB), but the majority will grow. A sample of body fluid – urine, pus, sputum, etc. is spread on an agar plate using a sterilized (by direct heating in a flame) piece of wire in a narrow zigzag pattern. The plates are then cultured at temperatures in the high 30s Celsius. The colonies which grow can then be examined using the above techniques.

Agar plates can be made using the following techniques:

The agar should be placed into shallow dishes with a lid – Petri dishes (100 mm by 15 mm) are what are traditionally used but you can improvise

Dissolve a vegetable stock cube and a gelling agent, usually 15 grams (1/2 oz) of agar, or one pack of all propose gelatine, or one jelly desert mix, in 1/2 cup (125 ml) of distilled boiling water. Make sure the gelling agent contains agar, carrageen, or guar gum.

To resterilize the dishes and lids place them in boiling distilled water. Leave them in the water to cool.

Pour the agar into a shallow Petri dish. It will form a jelly in each dish. Put the lid on and leave until the jelly is set. Store the dishes upside-down until you need them. This will stop water condensation from falling on the jelly.

Pregnancy Tests
The ability to accurately diagnose pregnancy may be important both for psychological reasons and for practical reasons. Currently available pregnancy test kits will test urine for the presence of the hormone Human chorionic gonadotrophin (HCG). They require only a small amount of urine and are accurate from 10-14 days from conception. The tests available in common grocery stores are nearly as sensitive as a laboratory test, in fact many Emergency Departments rely on this type for their rapid tests. These tests are inexpensive and widely available. Follow directions included with packaging.

Appendix: D MMCF Radios

2-Way Radios Instructions

ON, OFF, & VOLUME: Right knob
The long beep indicates it is on.

Channel Selection: Left knob

- Practice Channel:
  - For training and close proximity
  - Channel numbers are around the base of the knob
  - Turn white line on knob to channel 11 (screen will say Practice.)
- Other Channels:
  - All state MARC channels: many are repeated.
  - Fire Ground Blue, VTac
  - NATSAR, weather

Push-To-Talk Button: Long button on side of radio

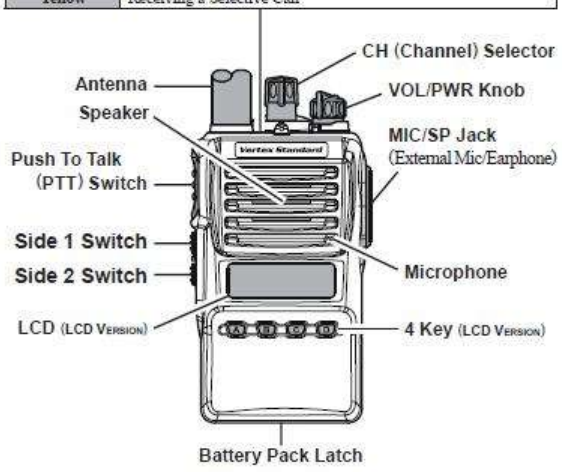
- Push button (keying up)
- Wait 2 to 3 seconds
- Start talking
- Release button to allow responses and conversations.

Communication Etiquette:

- Use plain English – 10-codes are not necessary
- Plan your message BEFORE talking on radio
- Do NOT discuss health or other personal information of patients or yourself

LED Indicator

Glows Green	Monitor on (or Side 1, or 2 switch is activated: Non-LCD version)
Blinking Green	Busy Channel (or SQL off)
Glows Red	Transmitting
Blinking Red	Battery Voltage is Low
Yellow	Receiving a Selective Call



NURSING GUIDELINES FOR PATIENT CARE

Section I. NURSING POLICIES AND PROCEDURES

GENERAL POLICIES

The goal of austere nursing is to provide safe nursing care in a limited resource environment.

The nature of the MMCF operation requires maximum emphasis on training for team members. This training should focus on the duties and responsibilities of each functional area of the MFMT. The Lead Patient Care Technician nurse provides overall supervision of the nursing care provided by the team and ensures training of team members on mission essential tasks of the unit.

Responsibility for patient accountability remains with the Planning Section. However, the MMCF Lead Patient Care Technician ensures that all patients received and treated at the facility are properly logged in and out on the HICS Patient Tracking Form (ICS 254). Minimum documentation should include patient identification, diagnosis and treatment, and disposition (date and time).

A record of medical treatment will be established/maintained for each patient treated by the MFMT at the MMCF. These records will be transported with the patient when they are evacuated from the MMCF to a definitive healthcare facility. Depending upon the operational scenario, the MMCF may be required in rare circumstances; to act as a low – acuity primary care facility in the absence of a supporting healthcare facility or healthcare system. Although the MMCF is neither staffed nor equipped to maintain individual health records, if it functions as a primary care facility, it is responsible for maintaining records on all patient encounters (such as routine sick call or outpatient visits). These records will be maintained until the patient is transferred from the MMCF or to another care facility. At that time, the records will be transferred to the gaining care facility.

Nursing Supervision

Nursing practice incorporates the activities of data collecting and assessing, implementing a plan of care, and evaluating patient care outcomes. Disaster nursing personnel must continually adjust priorities to meet the dynamic requirements of patient care, ancillary support, administrative tasks, and staff management.

The clinical, cognitive, and managerial skills of the nurse are of paramount importance to effectively function under the vigorous demands of an austere scenario. This environment may include limited staff, constrained facilities, equipment of limited capability, and a large percentage of patients suffering from acute traumatic injuries. In addition, the influx of casualties and the mission of the MMCF necessitate a shortened length of stay within its recovery area. Under normal circumstances, patients will be recovered from emergent care and prepared for aeromedical or ground evacuation within 6 hours, during the window of opportunity and prior to the occurrence of postoperative complications. If evacuation is delayed, it may be necessary to place a patient into a Holding/Observation long term care bed with continued supervision by the MMCF's nursing staff.

In primary nursing assessments, admission procedures include a patient-specific systems review based on the diagnosis. Emphasis is placed on the traumatized system(s) with minimal review of noninvolved areas such as:

- Assessment of dressings, tubes, IVs, and other support equipment.
- Administrative paperwork.

Although assessment, evaluation, and documentation are continuous processes, patients of the MMCF Holding/Observation Area require additional assessment and evaluation every hour, as a minimum, or as indicated by the patient's condition and/or anticipated disposition.

Nursing Care of the Patient in the Emergent Treatment/Stabilization Area

a. Circulator duties are performed as outlined below.
They include responsibilities for readiness of all equipment and supplies, safe patient care during treatment and continued patient care until recovery personnel assume responsibility for the patient.

1. Both beds should be fully prepared for stabilization procedures. The two beds may be employed simultaneously to provide emergent care capability and to avoid backlog.

2. Basic sterile/aseptic techniques, should be followed at all times.

3. Dependent upon patient flow and work-rest cycles, one circulator may circulate for both beds.

4. The collection and disposal of all body fluids is accomplished in accordance with infection control protocols and local preventive medicine guidelines. If a body part is to accompany a patient, it is placed in an appropriate container and labeled with the patient's name, number, and if possible social security number.

5. The patient identification process is completed and the medical record annotated minimum information should include name, SSN, and emergency contact.

6. Any clothing or personal effects that need to be removed from the patient should be labeled, and secured.

7. All sponges, needles, and instruments used with each stabilization operation MUST be accounted for.

8. Additional circulator duties may include:
   - Assisting in the preparation of IV medications.
   - Assisting with and directing the placement of splints and casts.
   - Assisting with monitoring the patient's vital signs and status.
   - Assisting with cardiopulmonary resuscitation as required.

Scrub duties are performed include:
- Following sterile technique and draping procedures.
- Taking steps to correct breaks in sterile techniques whenever possible.
- Completing surgical hand and arm scrub prior to gowning and gloving.
- Assisting other team members with their personal gowning, gloving, and draping procedures.
- Preparing, in advance, sutures, blades, instruments, and drapes needed for anticipated procedures.
- Assisting Emergent Stabilization/Treatment team throughout a lifesaving procedure, anticipating all instrument and supply needs.
- Assisting with sterile dressings; remaining sterile until instructed by the physician to "break scrub.
- Ensuring that all medical records accompany the patient into the next treatment area.

Indirect Patient Care

Indirect patient care time is increased for the MMCF compared to hospital facilities because of the limited resource environment; that is, facility design, location of oxygen, water, sanitation, removal of waste, and location of support services. Indirect care tasks *may* include, but are not limited to:

- Obtaining and preparing medications.
- Collecting equipment for procedures.
- Emptying bedpans, urinals, and drainage bottles.
- Disposing of contaminated waste.
- Resupplying the MMCF patient care areas.
- Assisting transporting patients.
- Obtaining and disposing of water.

Intravenous Standards

a. Intravenous-push medications can be given by paramedic, RN or an NP under physician orders.

b. Intermittent medications administered through saline locks are to be given by a Patient Care Technician-Nurse because of the requirement to flush the tubing before and after giving the medication.

c. Nursing personnel may administer blood products and IV piggyback medications if these items have been authorized by a physician or physician assistant.

Heparin/Saline Locks

Either Heparin or saline locks should be used for patients who require IV access only for the administration of parenteral medications; they are also used to avoid multiple venous punctures.

Medications

By physician order and under the supervision of a Patient Care Technician-Registered Nurse, or Paramedic any other level licensed Patient Care Technician may administer intramuscular, subcutaneous, IV drip, oral, sublingual, topical, inhaled, and rectal medications.

Vital Signs

Patients treated in the MMCF have undergone initial resuscitative stabilization to render them transportable to the next level of care. As such, it is essential that their vital signs be closely monitored to ensure that their medical condition is stabilizing and other immediate medical intervention is not required.

a. In the Emergent Treatment/Stabilization area, patient vital signs are taken as part of the initial assessment. If patients are to remain in the Emergent Treatment/Stabilization area for any length of time, the triage officer will determine at what frequency the vital signs should be taken.

b. During stabilization procedures, vitals signs are monitored continuously by the Patient Care Technician Nurse or Paramedic.

c. In the Holding/Observation area, vital signs are taken upon receipt of the patient. As patients are closely monitored in this area, vital signs are taken every 5 to 10 minutes until stable, then once every 30 minutes unless otherwise directed.

Intake and Output

a. Fluid intake and output is measured and recorded every hour at a minimum for critical patients. Every six hours for non-critical.

b. Intake and output measurements are done routinely on all Holding and Observation patients.

Foley® Catheters

a. Since Foley® catheters are to be changed every 7 days (to include catheter, tubing, and bag), this procedure is generally not done in the MMCF.

b. Patients who had Foley® catheters placed, should have them checked in the Holding and Observation Area.

c. Patients exiting the Emergent Treatment/Stabilization area who have Foley® catheters should be checked upon receipt in the Holding/Observation area and prior to medical evacuation.

Hyperthermia/Hypothermia

a. Management of hyperthermia is accomplished using tepid water sponges.

b. In patients receiving large volumes of IV fluids, prompt and effective management of hypothermia is critical for maintenance of hemostasis. Postoperative hypothermia is managed by using fluid warmers, area space heaters, or total body rewarming.

Fever

Reducing a Fever without Medications

a. Reduce the coverings over the body, such as clothing and bed linens. This allows for cooling via radiation. Expose as much of the patient's body surface as practical to open air.

b. The two most commonly used non-pharmaceutical mechanisms used to reduce fever can be classified as wet and dry treatments.

c. Wet treatments include sponge baths, cool compresses, and alcohol rubs. By wetting the body surface they increase evaporative heat loss. These work best when the humidity level is 90% or below.

d. Dry treatments include ice bags and chemical cold packs. The body itself is not made wet; instead cooling is effected by conduction.

e. A wet method of cooling via conduction is to partially immerse the body no deeper than mid-chest in tepid water (approximately 80 F). Cold water may cause the body lose too much heat, causing the opposite of fever, or hypothermia.

If the water causes shivering the temperature may actually rise instead.

Patient Hygiene

a. Patients entering the MMCF facilities may need to receive sufficient cleaning or decontamination to permit a basic assessment.

b. Stabilized patients are discharged or evacuated as rapidly as possible. Few patients are expected to remain beyond a few hours. Only that hygiene required to prevent skin breakdown, to ensure infection control, and to satisfy patient comfort is performed.

Dressings

a. Because of short stays in the MMCF, it is not anticipated that dressings will be changed on burns, or on IV or chest tube emplacements.

b. Tracheostomy dressings will be changed as needed.

c. On all Emergent patients, a "no peek" dressing policy will apply. This means that dressings will not normally be changed until the patients is reevaluated by a physician or Nurse Practitioner delayed primary closure dressings are reinforced by the nursing staff as needed.

Nasogastric Tubes

a. Unless otherwise indicated by patient condition, nasogastric (NG) tubes are irrigated as necessary and prior to evacuation. Unless otherwise ordered, NG tubes are placed to low suction or to dependent drainage during the observation phase.

b. Nasogastric tubes are essential in the management of many patients during aeromedical evacuation. The NG tubes are to be left open to air. They must not be clamped during aeromedical evacuation.

c. All patients diagnosed as having an intestinal obstruction are required to have a functioning NG tube in place before and during aeromedical evacuation.

d. Patients with stomach, intestinal, or colonic wounds should have a functioning NG tube in place before and during aeromedical evacuation.

Oxygen Administration

Oxygen if available is administered to all patients who exhibit signs and symptoms of moderate-to-severe respiratory distress, hypoxia, and moderate-to-severe cardiovascular compromise (such as shock, massive hemorrhages, or penetrating chest wounds).

Addressing Bodily Elimination Needs

The primary tools for addressing bodily elimination needs are the bedpan, the urinal, the rectangular basin. Virtually all elimination needs can be addressed with these items and a few accessories such as soap and washcloths. Bedpans come in two basic forms; the wedge-shaped fracture pan and the traditional deep bedpan. Urinals are used mostly for male patients; though specially designed female urinals are available they are rarely seen.

The rectangular basin serves as a multi-use container for washing and emesis catchment. It is far less prone to spilling than kidney-shaped emesis basins and also eliminates one extra item from the inventory.

Fracture Pan or Regular Bedpan

Fracture pans are usually the most convenient for women and children but they are limited in capacity and tend to spill more easily when removed. A traditional deep bedpan is more comfortable when fractures to the hips, pelvis or upper leg or back pain are not involved. In such cases a fracture pan, which is wedge shaped, is more comfortable for the patient. Males will find either style usable with the previous caveats in mind.

Urinals

Urinals are used most often by male patients for passing urine. They can be readily improvised from a coffee can or jar though the manufactured version is designed with an angle to the neck so that urine does not spill when the device is used. For male patients and caregivers alike they are easier to use than a bedpan. Female urinals are rarely used but are available. The bedpan is normally used for women.

Cleaning after Elimination

Soap and water combined with a washing cloth work best, a gentle, non-irritating soap without added antibacterial agents. Also consider using pre-moistened cloths (also known as baby wipes, etc). These are simply pre-wetted disposable cloths used to clean feces, urine, and emesis. Large sizes are available for health care use but the smaller version made for cleaning up babies will also suffice. Good quality paper towels can used to fashion wipes by adding soap and water to a basin, tossing in the paper towels to absorb the mixture, and then wringing out the excess water and placing them in plastic bags for later use. Do not overlook toilet tissue as the most basic aid to cleaning up. Remember urine, feces, and emeses are all potential disease carriers. Therefore, gloves for the caregiver are a must. You will use more gloves for purposes of cleaning up patients requiring hygiene assistance than you are ever likely to use for addressing wounds or performing other procedures. The bedpans, urinals and basins themselves should be cleaned with soap and water after use and set out to dry or they will become a source of unwelcome odors.

Handling Vomit

Emesis basins (kidney-shaped plastic or metal pans) are available; they are of limited capacity and spill readily. Better suited is a basin of approximately 6 inches depth and rectangular in shape. It holds more and doesn't tend to allow a forceful vomit to splash out of the container. Another alternative is a plastic bag such as a small dustbin or wastebasket liner. A 6 or 8-inch diameter embroidery hoop will hold it open and give the patient something to hang on to. To close it merely grasp the bag with one hand and twist the hoop around with the other. Once removed from the hoop frame it can be sealed using string or a metal twist-tie. The plastic bag has the advantage of being flexible and semi-spill proof, as well as easily disposed of. Another expedient holder is a wire coat hanger pulled open to form a diamond shape to which the plastic liner has been securely taped.

Disposable Linen

Due to the limited weight and cube of the MMCF and the shortened length of stay, all patient care linens are disposable.

Bedpan and Urinal Wash Point Procedures

a. Patients are to have their human waste receptacles (urinal or bedpan) disinfected after each use. A designated area for sanitizing receptacles should be used. This area should be clearly marked "for use in cleaning bedpans and urinals only.

b. Alternative procedures using impermeable disposable bags may be used to collect and dispose of urine and feces.

POSTOPERATIVE RECOVERY CARE

Guided by the principles of disaster/austere medicine, Holding/Observation Area team members perform nursing care and treatment procedures under the supervision of the Lead Patient Care Technician which should be a Nurse Practitioner or Registered Nurse with supervisory experience according to established SOG's and individual licensed Scope of Practice.
These procedures may include, but are not limited to, the following:

- Performing airway management and extubation.
- Performing continued fluid therapy.
- Instituting postoperative rewarming as indicated.
- Administering medication per scope of practice by Physicians' or local medical control order for example, analgesia, reversal agent, or antibiotics.

- Ensuring proper identification of patient before administering medications.
- Performing nursing measures to control pain and anxiety.
- Providing proper positioning and maintenance of cervical spine immobilization.
- Securing and positioning splints and casts.
- Performing special skin care and minor wound care as required.
- Providing a safe environment for patients by ensuring that all equipment is grounded and that no drugs, sharp objects, or weapons are left within their reach.
- Communicating the fire evacuation plan and emergency procedures in the event of hostilities.
- Providing patient instructions, as required.
- Manage controlled substances in accordance with DEA requirments. Store narcotics and other controlled substances in a locked box that is under the surveillance of the recovery team.

Recovery Care Techniques and Procedures

The scope of recovery care activities encompasses those nursing practices, techniques, and procedures implemented to provide for the care of a patient after emergency life saving stabilization.

Care of the critically ill patient is inclusive of the execution of the physician orders. It involves the recovery of patients from the Emergent Treatment/Stabilization Area and continues through the time that they are medically evacuated. This care is supervised by the Lead Patient Care Technician and entails the following procedures:

1. Holding and Observation Area personnel monitor the Emergent/Stabilization Area to determine the estimated time of case completion. They set up the recovery area to include all equipment required for immediate use.

2. An initial evaluation of the stabilized patient is completed prior to movement from the Emergent Treatment/Stabilization Area to the Holding/Observation Area and may include some or all of the following:
    - Assisted ventilation intact with endotracheal and tracheostomy tubes secured.
    - Circulatory status assessed.
    - Drainage devices and IV catheters in place and secured.
    - Splints intact.

- Patient is secured on the litter.

3. Upon taking charge of the patient from the Emergent Treatment/Stabilization Area, secure his personal effects bag from the circulator and inventory (if not already completed) the contents as soon as possible.

4. Once in the Holding/Observation Area, the nursing evaluation can proceed in a deliberate manner to ensure review and management of the primary system of involvement, as well as detection and appropriate treatment of less severe injuries. Review the medical record and the Treatment/Stabilization Team verbal report to determine the following:

- Diagnosis, location, and nature of injuries.
- Stabilization(s) procedure and application of any drainage devices.
- If any anesthesia, analgesia, and/or reversal agent used and time of last dose.
- Special requirements.

5. Take initial vital signs immediately upon arrival of patient in the Holding/Observation Area and as indicated by condition or change in condition. The preferred method for obtaining the patient's temperature is by use of a digital thermometer.

6. Determine patient airway patency. Place the patient on oxygen via mask at a rate prescribed by the Treatment/Stabilization Team Leader. If patient is intubated, ensure the endotracheal tube is secured.

7. Connect chest tube to pleural drainage at 20 centimeters (cm) suction.

8. If available place the patient on the ventilator per Operations Section or local medical control orders or anesthetist direction.

Initial oxygen supplementation should be 5 liters per minute. Initiate the following settings for ventilator assistance:

a. Synchronized intermittent mandatory ventilation (simv) 12/minute tidal volume (tv) 12 cc/kilogram.

b. Oxygen flow to maintain oxygen saturation >90 percent positive end-expiratory pressure (peep) 5 cm. peak flow as directed and adjust as needed.

Subsequent adjustments are made based on pulse oximeter and patient condition.

Extubation criteria:

- Patient's spontaneous respiration is 14 to 20 inhalations per minute.
- Patient is able to cough and breathe.
- Pulse oximeter setting must be no less than 92 percent.
- Patient arouses spontaneously and can lift head off bed.
    - Caution do not extubate a patient with an inhalation injury, a surgical spine injury, or a requirement for continued assisted ventilation.

9. Nasogastric suction: regulate NG tube to low suction or drainage.

10. Assess for adequate fluid resuscitation and shock. Signs and symptoms of shock include tachypnea, hypotension, low urine output, paleness, diaphoresis, and delayed capillary Refill (>3 seconds).

a. Control bleeding. Note amount. Use pressure dressings as needed. Notify nurse or physician if bleeding persists or chest tube output is greater than 150 cc per 30 minutes.

b. Ensure adequate fluid resuscitation.

I. If available crystalloid replacement with normal saline solution is usually done with 3 cc of crystalloid for each 1 cc of estimated blood loss. 150 cc per hour—bolus 500 to1,000 cc—then increase fluid rate to 200 cc to achieve a blood pressure of equal to or greater than (≥) 100 mm of mercury (mm hg) and/or urine output of >30 cc per hour.

II. Persistent hypotension or urine output less than 30 cc per hour is reported to the nurse or physician for potential use of colloid.

III. Monitor patient's response to fluid resuscitation to include pulse, blood pressure, urine output, level of consciousness, capillary refill, and pulse oximetry.

11. Evaluate distal circulation and injured extremities, and ensure fractures are stabilized with appropriate splints or casts.

a. Elevate injured extremities unless contraindicated.

b. Assess pulses and capillary refill. Ensure circulation is not impaired by dressings, splints, casts, or improper positioning.

c. Perform gross motor and neurological assessment for level of consciousness, gross motor strength, movement, and sensation. Document deficiencies, monitor improvement or deterioration of status, and notify nurse or physician as required.

12. If available monitor for cardiac abnormalities as a result of chest injuries, electrolyte disturbances, and shock.

a. Recognize PVCs, asystole, tachycardia, ventricular fibrillation, and atrial fibrillation.

b. Notify physician or if available an anesthetist and initiate advanced cardiac life support protocols as indicated

13. Set up and operate pulse oximeter. Place all patients with an irregular pulse or a pulse greater than 100 beats per minutes on a cardiac monitor if available.

Recognize common electrocardiogram abnormalities and report any of the following to the Lead Patient Care Technician:

- Premature ventricular contractions (PVCs).
- Ventricular fibrillation.
- Tachycardia.
- Asystole.
- Atrial fibrillation.

Additional assessment parameters include:

- Inspecting the injury site and noting any bleeding or abnormal drainage.
- Evaluating distal circulation of injured extremities, as applicable.
- Performing neurological assessment, to include level of consciousness, gross motor strength, gross sensation, and emotional status.
- Checking all skin surfaces for abnormal conditions.
- Monitoring patient’s intake and output according to SOG’s.

Provide continued airway management, supportive care, and monitor vital signs every 5 to 10 minutes until the patient is stable.

Prepare Patient for and Release to Medical Evacuation

The MMCF Holding/Observation Area has the responsibility of preparing patients for release into the medical evacuation chain. The evacuation of a patient is initiated by the Emergent Treatment and Stabilization Team Leader and or the Operations Section Chief in accordance with established unit SOG. The Holding/Observation Area coordinates the movement of the patient and ensures that the

- Medical evacuation request includes requirement for medical equipment and/or providers.
- Patient is sufficiently stabilized for the anticipated mode and duration of travel.
- Patient's airway and breathing is adequate for movement.
- Patient at high risk for barotrauma considered for prophylactic chest tube placement before prolonged aeromedical evacuation (consult physician).
- Personal effects and all medical records accompany the patient. Personal effects (money, documents, pictures, jewelry, and the like) will be documented by the MFMT Administration personnel and accompany patients when they are evacuated from MMCF.

1. Ascertain medical evacuation travel time of patient to the next level of care.

2. Ensure adequate airway. Secure endotracheal or tracheostomy tube if intubated. Request from evacuation transporter Ambu Bag, oxygen support, and other equipment as required.

3. Secure IV lines. Ensure large bore IV sites and tubings are in place and secure. Provide IV fluids if the need for bag replacement during flight is anticipated.

4. Secure Foley® catheter and other drainage tubes. Do not clamp Foley® catheters or Ng tubes. The Foley® catheter is connected to the drainage bag. The NG tube is left open to allow drainage.

5. Discontinue chest suction and ensure Heimlich valve is functioning on all chest tubes.

6. Wrap patient securely covered with both a woolen and aluminized blanket for air transport, cold environment, and/or postoperative hypothermia and secure litter with a minimum of 3 litter straps. Ensure that no blankets or supplies are left loose on the litter.

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